TEKTRONIX®

8001/8002

μPROCESSOR LAB

REAL-TIME PROTOTYPE ANALYZER

SERVICE

INSTRUCTION MANUAL

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8001/8002

μPROCESSOR LAB

REAL-TIME PROTOTYPE ANALYZER

SERVICE

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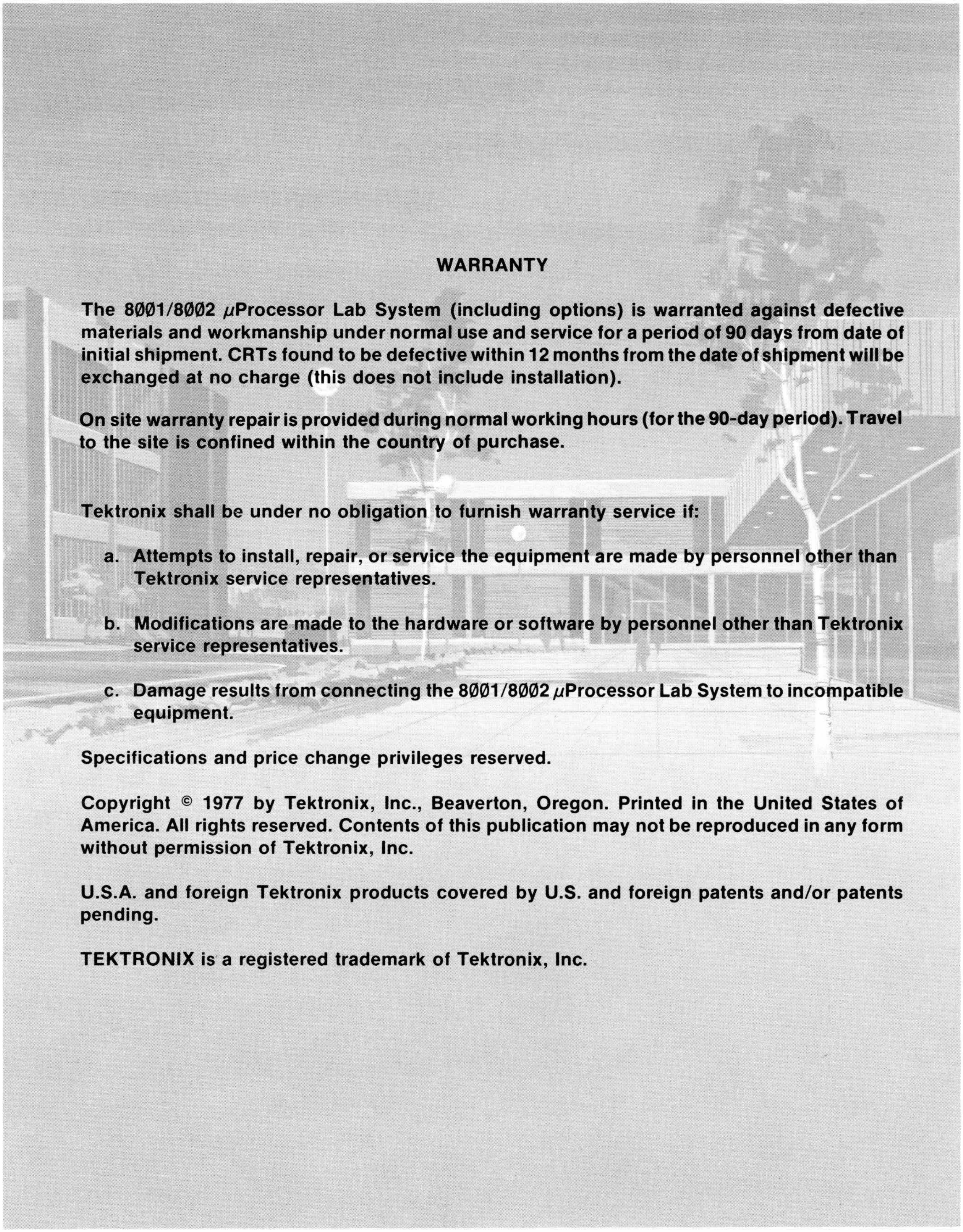

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The 8001/8002 μProcessor Lab System (including options) is warranted against defective materials and workmanship under normal use and service for a period of 90 days from date of initial shipment. CRTs found to be defective within 12 months from the date of shipment will be exchanged at no charge (this does not include installation).

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CAUTION

STATIC DISCHARGE CAN DAMAGE MANY SEMICONDUCTOR COMPONENTS USED IN THIS INSTRUMENT.

Many semiconductor components, especially MOS type components, can be damaged by static discharge. Damage may not be catastrophic, therefore, not immediately apparent. It usually appears as a "weakening" of the semiconductor characteristics. Devices that are particularly susceptible are: MOS, CMOS, J FET's, and high impedance OP amps. Damage can be significantly reduced by observing the following precautions.

Before removing or inserting any module in the μProcessor Lab, the operator should touch or contact the chassis of the Lab to discharge any static buildup he might acquire.

Use containers made of conductive material or filled with conductive material for storage and transportation. Avoid using ordinary plastic containers. Any static sensitive part or assembly (circuit board) that is to be returned to Tektronix, Inc., should be packaged in its original container or one with anti-static packaging materials.

Before removing or inserting a module or the Prototype Control Probe plug, insure that all power is OFF.

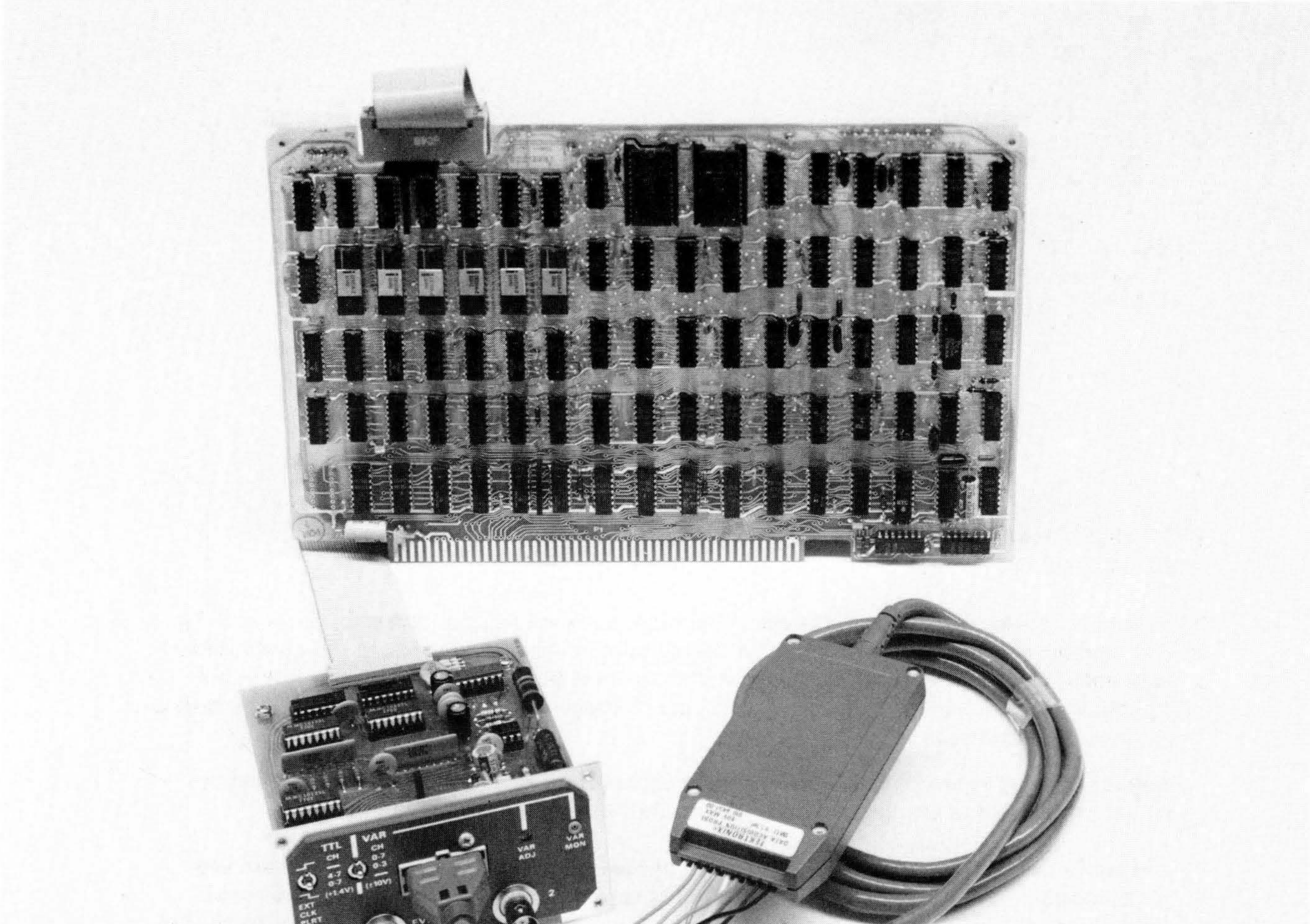

Fig. 1-1. Real-Time Prototype Analyzer.

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Section 1
GENERAL INFORMATION

INTRODUCTION

The Real-Time Prototype Analyzer is an 8001/8002 μProcessor Lab option that allows users to monitor hardware and software functions during real-time execution. The Real-Time Prototype Analyzer consists of the following three sub-assemblies:

1) The Real-Time Trace module
2) The Data Acquisition Interface board
3) The Data Acquisition Probe

The Real-Time Trace module is a circuit board that plugs into the 8001/8002 μProcessor Lab motherboard. The Real-Time Trace module contains all the circuitry required to store up to 128 bus transactions. The Real-Time Trace module also issues trigger pulses and/or breakpoints upon programmed event comaprisons.

The Data Acquisition Interface is a circuit board that attaches to the rear panel of the 8001/8002 μProcessor Lab. The Data Acquisition Interface contains all the buffers, drivers, and receivers that interface the Real-Time Trace module to the nine channel Data Acquisition Interface.

The Data Acquisition Probe is an active nine channel data probe. Eight of the channels are used to input data to the Real-Time Trace module. The ninth channel carries a clock signal from a prototype device. Since a data booklet is packaged with the Data Acquisition Probe, no attempt will be made in this manual to describe the Probe in detail.

The Real-Time Prototype Analyzer is operational while an Emulator Processor module is active. The Real-Time Prototype Analyzer monitors and may store up to 128 bus transactions. The stored bus transactions may include information from the following sources:

1) 16 address channels
2) Up to 16 data channels
3) Three control signals ($\overline{\text{M}}$/IO, R/$\overline{\text{W}}$, and FETCH)
4) Eight data channels from the Data Acquisition Probe

The Real-Time Prototype Analyzer may be programmed to collect all or part of the information available.

Another feature of the Real-Time Prototype Analyzer is the ability to compare specified events. An "event" is an ANDed combination of address, data, control, and Data Acquisition Probe information.

The Real-Time Prototype Analyzer contains two event comparators. When the result of a programmed event comparison is true, the Real-Time Prototype Analyzer may issue a trigger pulse to the rear panel of the μProcessor Lab and/or a breakpoint to the system.

Counting circuitry in the Real-Time Trace module can be utilized to cause a delay between the detection of an event and the generation of a trigger or breakpoint.

The factors controlling delay include:

1) A predetermined number of program clock pulses
2) A predetermined number of event reoccurrences
3) A predetermined number of specific bus transaction reoccurrences
4) A predetermined number of instruction reoccurrences
5) Real-Time (milliseconds or microseconds)

The Real-Time Prototype Analyzer will also detect a missing Emulator Processor clock. The Real-Time Prototype Analyzer automatically notifies the system and an error message is displayed on the console.

OPTION ACCESSORIES

Real-Time Prototype Analyzer Service Manual.

JUMPERS/SWITCHES

There are no jumpers or switches on the Real-Time Trace module. One jumper is located on the Data Acquisition Interface and is discussed in that section.

SOFTWARE

The following is a short summary of Real-Time Prototype Analyzer software commands. A more complete explanation of each command may be found in the 8002 μProcessor Lab System User's Manual or the 8001 Programmer's Reference Manual.

Command	Function
EVT	Set or display Event Comparator Trigger options.
BIF	Set or clear breakpoint options.
RTT	Select transaction type to be stored.
DRT	Display Real-Time Trace Buffer contents.
CNT	Set or display Pass and Delay Counter units count.

The preceding commands are used to set up the operating parameters for Real-Time Trace operation. Once the parameters are established, the Real-Time Prototype Analyzer operates within them. If a programmed breakpoint is reached and a new GO xxxx command is issued, the Real-Time Prototype Analyzer operates within the previously established parameters. Operating parameters can only be changed while the System Processor has control of the system.

Installation

The Data Acquisition Interface attaches to the rear panel of the 8001/8002 μProcessor Lab. The circuit board resides inside the μProcessor Lab with the panel of the Data Acquisition Interface flush with the rear panel of the Lab as shown in Fig. 1-1. The Data Acquisition Interface should be attached to the 8001/8002 μProcessor Lab in the following manner:

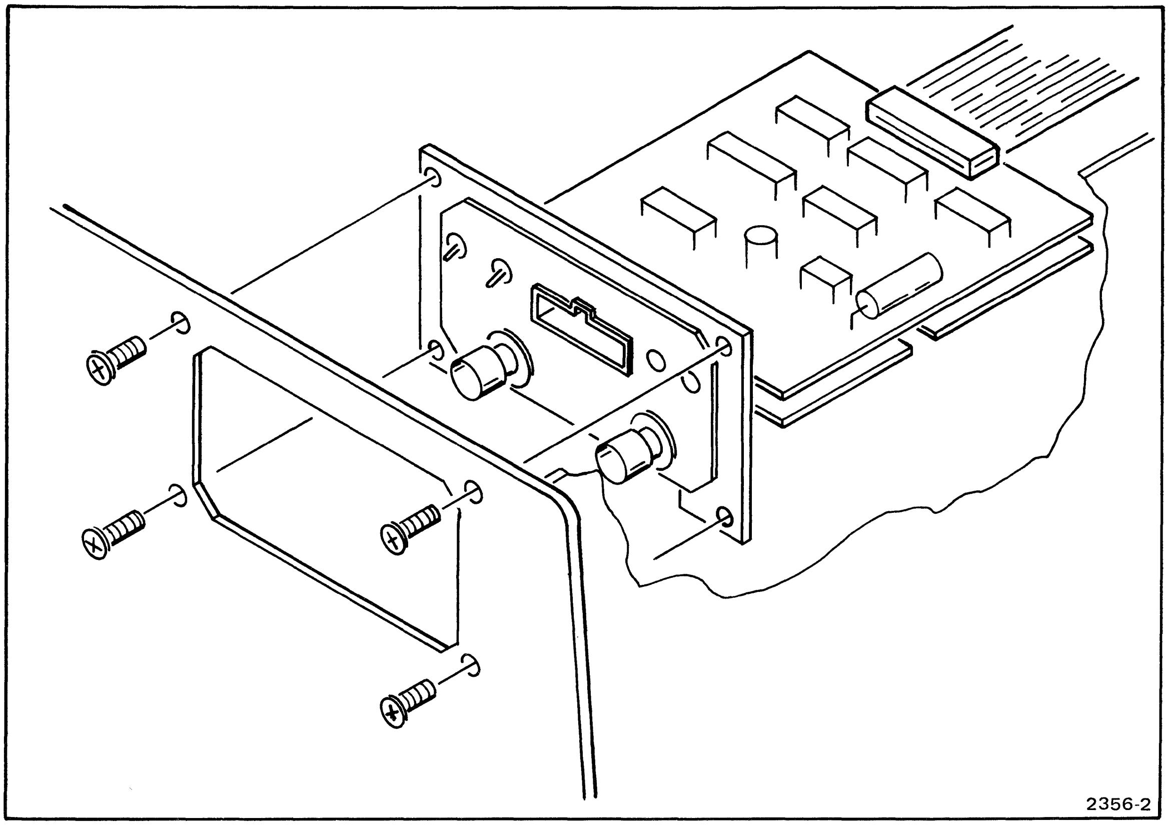


Fig. 1-2. Data Acquisition Interface Installation.

1) Make sure that the main power to the μProcessor Lab is OFF.
2) Remove the three Phillips head screws along each side of the top cover of the μProcessor Lab.
3) Lift straight up on the cover of the μProcessor Lab and set it aside.
4) While facing the rear panel of the μProcessor Lab, notice the four No. 4-40 screws holding a blank plate to the rear panel in the upper right hand corner. Remove the screws and the plate and set them aside.
5) Place the Data Acquisition Interface circuit board inside the μProcessor Lab chassis with the component side up and the panel facing the rear of the Lab.
6) Align the four screw holes in the Data Acquisition Interface panel with the four screw holes in the μProcessor Lab rear panel.
7) Thread the four No. 4-40 screws back into the rear panel of the μProcessor Lab and tighten.

Now the Real-Time Trace module may be installed as follows:

1) While facing the front of the 8001/8002 μProcessor Lab, grasp the module by the upper edges with the component side facing left.
2) Slide the module down the guide channels labeled J15 (for cabling convenience).
3) As soon as P1 (the lower edge connector) of the Real-Time Trace module reaches the motherboard connector, press down firmly and evenly on the top edge of the module until the module snaps into place.
4) Attach the ribbon cable from the Data Acquisition Interface to the Real-Time Trace module edge connector P2. Insure that pin 1 of the ribbon cable (red stripe) and pin 1 of the edge connector align.
5) Replace the top cover of the 8001/8002 μProcessor Lab. Thread the six screws (previously removed) back into the sides of the cover and tighten.

The Data Acquisition Probe may be connected to the Data Acquisition Interface as needed. The Data Acquisition Probe cable end is keyed to assure proper connection.

SPECIFICATIONS

Real-Time Trace Module
Electrical Characteristics

Voltage	Current
+5.2 Vdc	2.4 A typical
Dissipation	Approximately 12 watts

Environmental Characteristics

Ambient Air Temperature	
Operational	0°C to 70°C (+32°F to +158°F)
Storage	–55°C to +80°C (–67°F to +167°F)
Humidity	To 90% relative non-condensing
Altitude	
Operational	To 15,000 feet maximum
Storage	To 50,000 feet maximum

Data Acquisition Interface Specifications
Electrical Characteristics

Voltage	Current
+12 Vdc	20 mA typical.
–12 Vdc	400 mA maximum with Data Acquisition Probe 125 mA maximum without Data Acquisition Probe
+5.2 Vdc	400 mA maximum
Dissipation	Approximately 7 watts

Environmental Characteristics

Same as Real-Time Trace module

Input/Output Characteristics

Variable Threshold Range	> +10 Vdc to < −10 Vdc
Preset TTL Voltage	+1.4 Vdc ±200 mV
Event Trigger Out	High level voltage out > +2 Vdc
Adjustments	Variable threshold may be adjusted from > +10 Vdc to < −10 Vdc with a screwdriver adjustment accessible at the rear panel of the 8001/8002 μProcessor Lab. This voltage must be monitored with a voltmeter having an input impedance of at least 10 MΩ.

Section 2
THEORY OF OPERATION

NOTE

Because of internal nomenclature changes in the 8001/8002 µProcessor System, the bus line names called out on some schematics may not reflect the nomenclature used in the manuals. To reduce possible confusion, here is a list of the old and new system nomenclature:

Old Name	New Name
Master	System
Master CPU	System Processor
Master Memory	System Memory
Slave	Emulator
Slave CPU	Emulator Processor
Common Memory	Program Memory
Enter	Deposit (This occurs only on the Maintenance Front Panel and in the Debug and Front Panel I/O board.)

This section describes the inner functions of the Real-Time Prototype Analyzer. A description of the information storage and comparison operations are discussed first. A more detailed description of the circuitry follows. A block diagram of the Real-Time Trace module is shown in Figure 2-1.

STORAGE AND COMPARISON

Information storage and event comparison occur simultaneously in the Real-Time Trace module. Both the storage and comparison functions evolve around the SLV OPREQ (SlaVe OPeration REQuest) line of the 8001/8002 µProcessor Lab bus.

SLV OPREQ initiates the following two bus-sequences within the Real-Time Trace module, both based on the leading and trailing edge of SLV OPREQ:

Leading Edge

1A On the leading edge of SLV OPREQ, 16 address bits, three control signals, and five identification code bits are stored in the multiplexer register.

1B If the previously established requirements are met, the buffer register contents are stored in Trace memory and the Trace Memory pointer is incremented.

1C Concurrent with 1B (above), event comparison requirements are tested for event comparator 1 and event comparator 2. The results of each comparison are placed into a shift register.

1D Concurrent with both 1B and 1C (above), the Real-Time Trace module determines if the current operation is an instruction fetch. If the current operation is an instruction fetch, and a breakpoint is set to occur at an instruction fetch, the next program counter value is stored. If the operation is an instruction fetch but a breakpoint is not set to occur, the last program counter value is stored.

Trailing Edge

2A On the trailing edge of the SLV OPREQ, 8 to 16 data bits from the 8001/8002 μProcessor Lab bus and eight channels of data from the Data Acquisition Probe are stored in the multiplexer register.

2B If the previously established requirements were met during the leading edge of SLV OPREQ, the buffer register contents are stored in Trace memory and the Trace memory pointer is incremented.

2C Concurrent with 2B (above), the bus data and Data Acquisition Probe information is compared to event comparator 1 requirements, then to event comparator 2 requirements. If comparison requirements are met, then a trigger pulse and/or breakpoint may be generated.

Real-Time Trace

Real-Time Trace module has the capability to store up to 128 bus transactions in resident trace memory. Transaction information is in the form of address, data, and control information from the μProcessor Lab bus, and data from the Data Acquisition Probe. This information is stored in a circular fashion in trace memory; that is, the information is presented to trace memory continually in what may be considered serial form. As new information is gathered, the oldest information is lost. At any point during user program execution, execution may be stopped, and the information stored in the trace memory may be examined.

Execution may be stopped by an event detection and breakpoint. At this time the stored information represents the last 128 transactions.

The occurance of a breakpoint may also be delayed a preset amount of time or clock pulses to allow the observation of events both before and after the breakpoint event.

Storage Capability

This section will deal with the storage capability of the Real-Time Prototype Analyzer.

All storage and comparison functions evolve around the SLV OPREQ (SLaVe OPeration REQuest) signal as follows:

1) On the leading edge of SLV OPREQ, the input multiplexer (see Fig. 2-1) allocates space for the μProcessor Lab address bits, control signal bits, and a five bit-identification code.

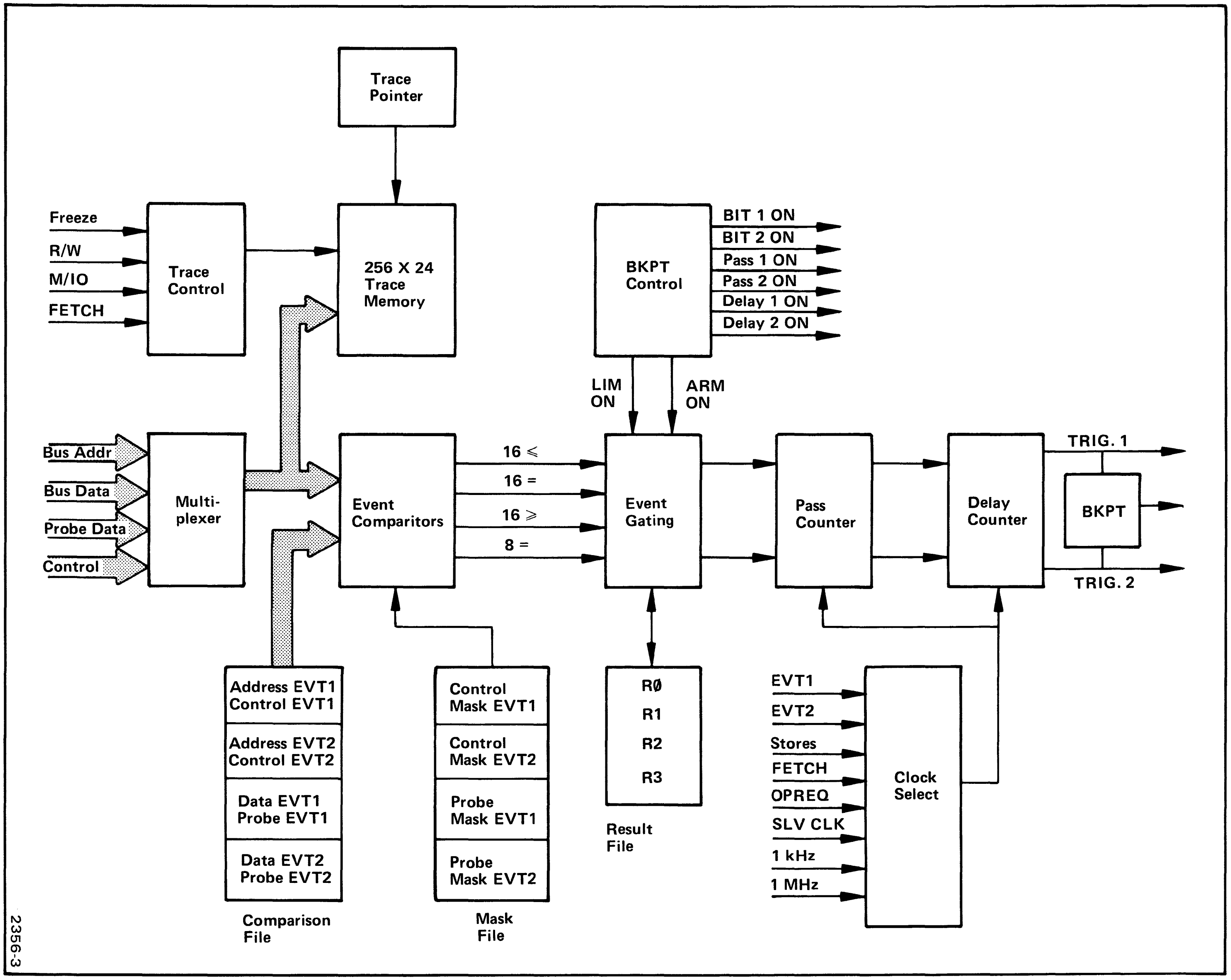


Fig. 2-1. Real-Time Trace Module Block Diagram.

2) A STR (SToRe) pulse is generated which clocks the information into the storage register of the multiplexer. The 24 bits of data are now available to the trace memory.

3) The write control circuitry detects whether this information is to be stored. If the information is to be stored, a WRMEM (WRite MEMory) strobe is generated which writes the information into memory.

4) This action in step 3 causes the trace pointer (a counter used to keep track of stored information) to be incremented.

5) On the trailing edge of SLV OPREQ, the input multiplexer allocates space for up to 16 data bits from the μProcessor Lab bus and 8 data bits from the Data Acquisition Probe.

6) The STR pulse is again generated causing the information to be placed into the multiplexer register.

7) The previous write control decision is still held, causing a WRMEM strobe to be generated (if the previous decision was to store).

8) Bus data and Data Acquisition Probe information is then stored in trace memory. The trace pointer is again incremented.

Both storage operations previously described are performed at each selected Emulator Processor transaction.

The information is stored in trace memory as 48 bit words. The System Processor can read only 8 bit bytes, therefore, a three bit shift register provides sequential output enables (OE1, OE2, OE3) to the trace memory. Six bytes of information must be read for each transaction stored. The trace pointer is incremented at the trailing edge of OE2.

Storage of 128 bus transactions requires that 786 bytes of information be read by the System Processor. The information is read from the oldest stored data to the newest stored data.

The System Processor reads the stored information by accessing read port $C1_{16}$.

TRACE CONTROL LOGIC

The trace control logic, under direction of system software, determines if the information gathered by the Real-Time Trace module will be stored in trace memory. See Figure 2-2 for a simple block diagram of the trace control logic. A timing diagram of the trace control logic is shown in Figure 2-3.

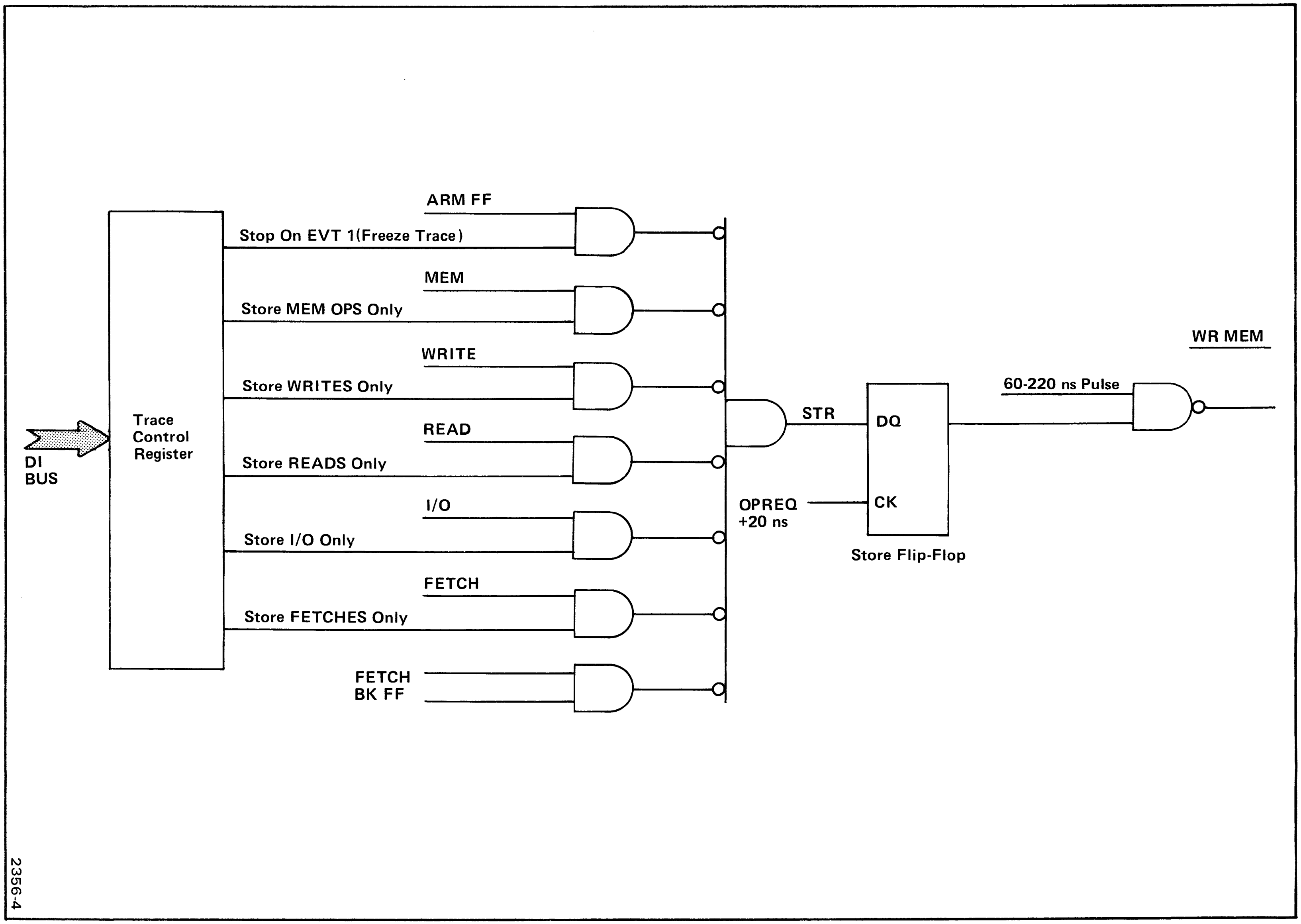
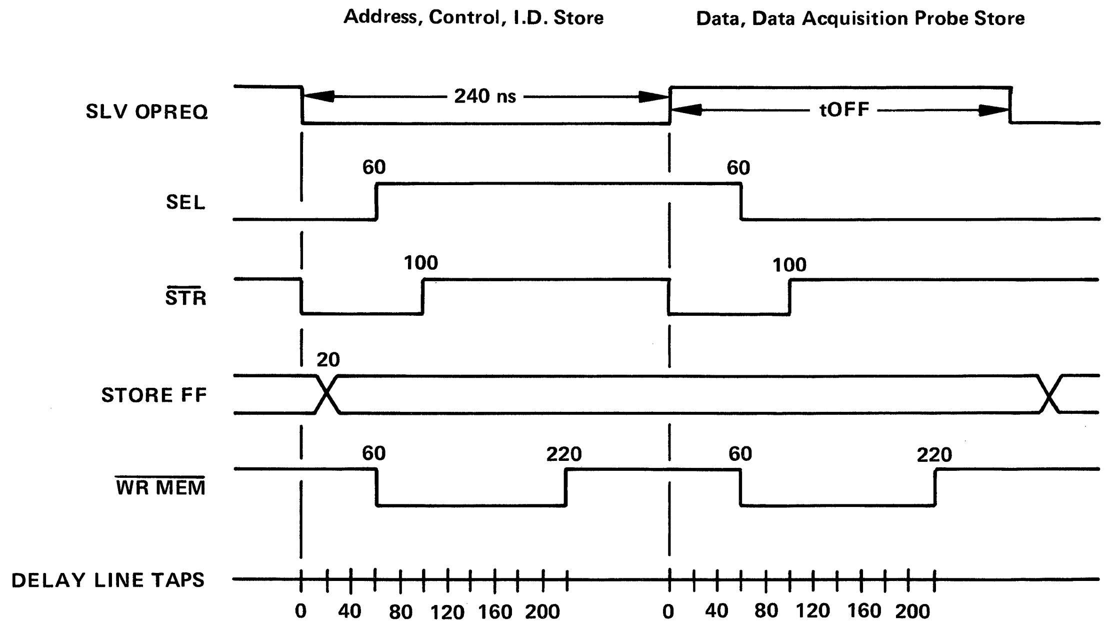


Fig. 2-2. Trace Control Block Diagram.



SLV OPREQ — Bus synchronizing signal

SEL — Select line to input multiplexer
  0 = Select Address, Control, ID
  1 = Select Data, Probe

STR — Clock to input storage. Data is stored on falling edge.

WR MEM — Write strobe to TRACE buffer. Trailing edge clocks the TRACE pointer. This signal is gated by the store FF.

Store FF — Trace conditions set by the operator are tested 20 ns after OPREQ to control the store operation.

Delay Line Taps — A 200 ns delay line is used to generate all basic timing.

2356-5

Fig. 2-3. Trace Control Timing Diagram.

System software loads a trace control byte in the trace control register. This register selects the type of information to be stored in trace memory. See Table 2-1 for the configuration of the trace control byte. The STR pulse is generated only if the conditions dictated by the trace control byte are met.

Table 2-1

0	Trace Fetch
1	Trace I/O
2	Trace Reads
3	Trace Writes
4	Trace Memory
5	Stop on EVT 1 (Freeze)
6	Reset Trace Pointer
7	not used

Bit 0 — Trace Fetch—When this bit is asserted, instruction fetch operations are stored in trace memory.

Bit 1 — Trace I/O—Assertion of this bit requires that Emulator Processor I/O accesses be stored in trace memory.

Bit 2 — Trace Reads—When this bit is asserted, memory read operations are stored.

Bit 3 — Trace Writes—When this bit is asserted, memory write operations are stored.

Bit 4 — Trace Memory—When this bit is asserted, all memory operations are asserted.

Bit 5 — Stop on EVT 1 (Freeze Trace)—Asserting this bit causes the Trace action to be stopped upon detection of the first event comparison.

Bit 6 — Reset Trace Pointer—Asserting this bit causes the trace pointer to be reset to its lowest value.

Bit 7 — Not used.

If bit 5 (Stop on EVT 1) of the trace control byte is asserted, trace memory stops recording information as soon as an event is detected. An arm flip-flop must be set by event 1, which in turn causes the recording to stop.

The instruction Fetch pulse as illustrated in the simple block diagram in Figure 2-2, is fed to two gates. Fetch and an input labeled break flip-flop enter the lower gate. If the break flip-flop is set (a software action) Fetch operation storage is inhibited.

The store flip-flop samples the decisions made by the trace control circuitry. The sample is made 20 ns following the leading edge of SLV OPREQ.

If an output pulse (W MEM) is generated by the store flip-flop, the pulse will be approximately 160 ns in duration and occur 60 ns from both the leading and trailing edges of SLV OPREQ.

EVENT COMPARISON LOGIC

This section explains the dual event comparators. Event comparison is accomplished by loading event requirements into a register file. As bus transactions occur they are compared with the stored requirements. If the occurring events match the stored requirements, an event trigger and/or breakpoint is issued. Dual comparison logic allows independent Event 1 and Event 2 conditions. A simplified block diagram of the event comparison logic may be found in Figure 2-4.

Event comparison timing is illustrated in Figure 2-5.

There are four sequential operations performed during event comparison: two from the leading edge of SLV OPREQ; and two from the trailing edge of SLV OPREQ. A flow chart of the operations may be found in Figures 2-6, 2-7, and 2-8.

The sequences take place as follows:

One

1a) Software directs the System Processor module to load the comparison data into the requirement files.

1b) The Emulator Processor is allowed to run.

1c) On the leading edge of SLV OPREQ, the 16 address and three control bits are loaded into the multiplexer storage registers.

1d) All comparator register files access their 00 register simultaneously. This provides EVT 1 address, control bits, and EVT 1 bus operation mask requirements.

1e) The 16 bit magnitude comparator (7485) compares the 16 bit address input to the EVT 1 address requirements.

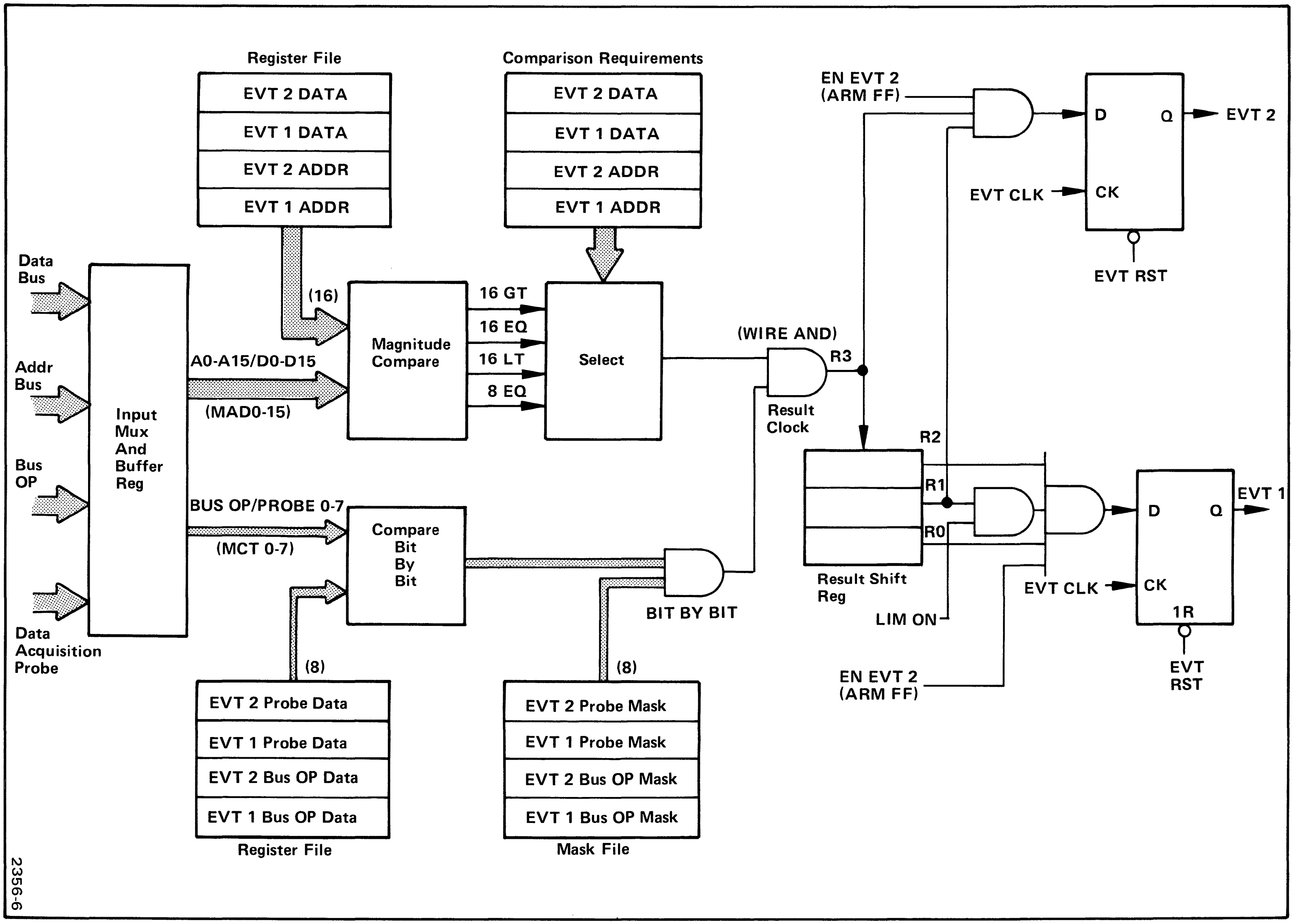


Fig. 2-4. Event Comparison Block Diagram.

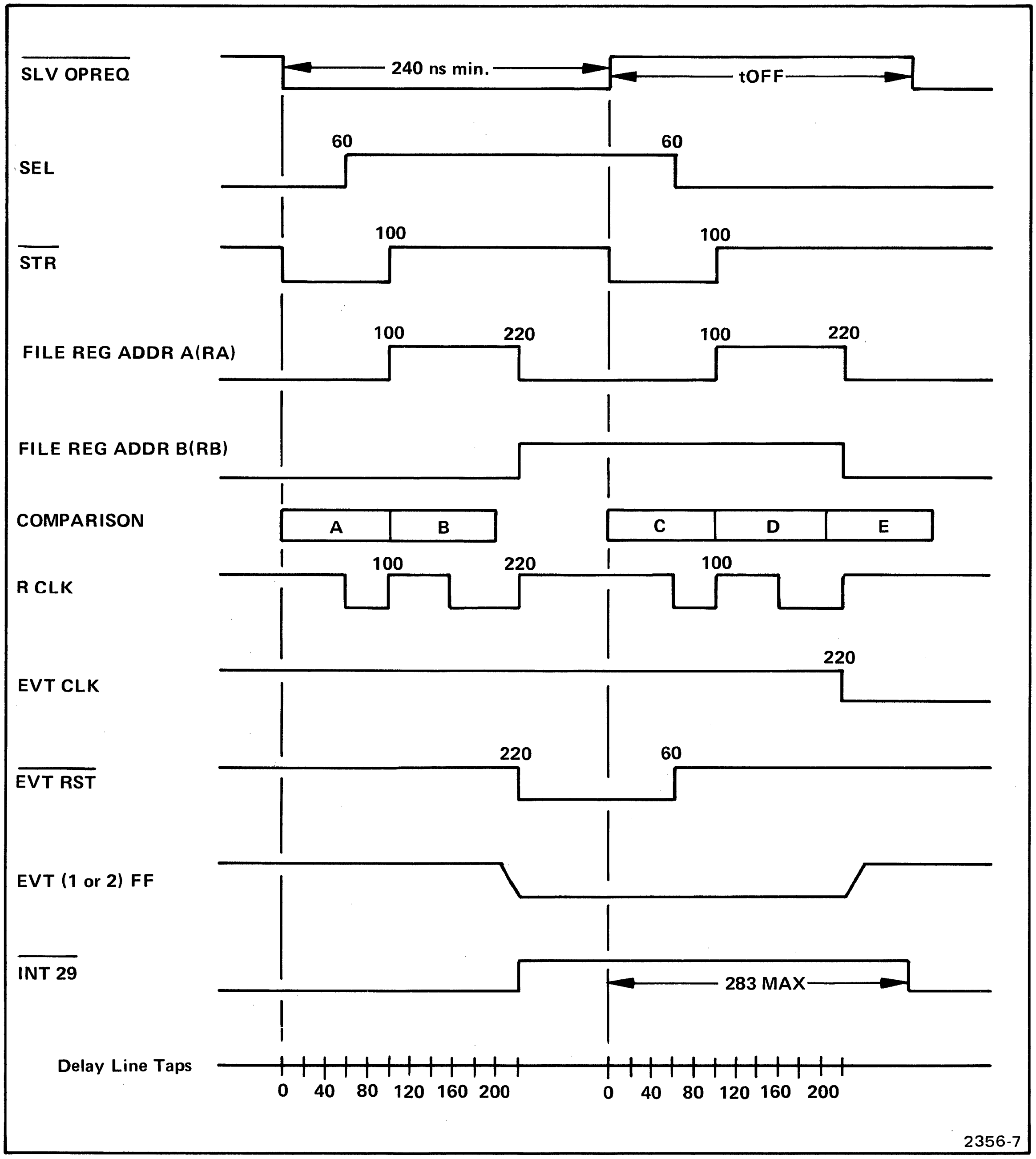


Fig. 2-5. Event Comparison Timing Diagram.

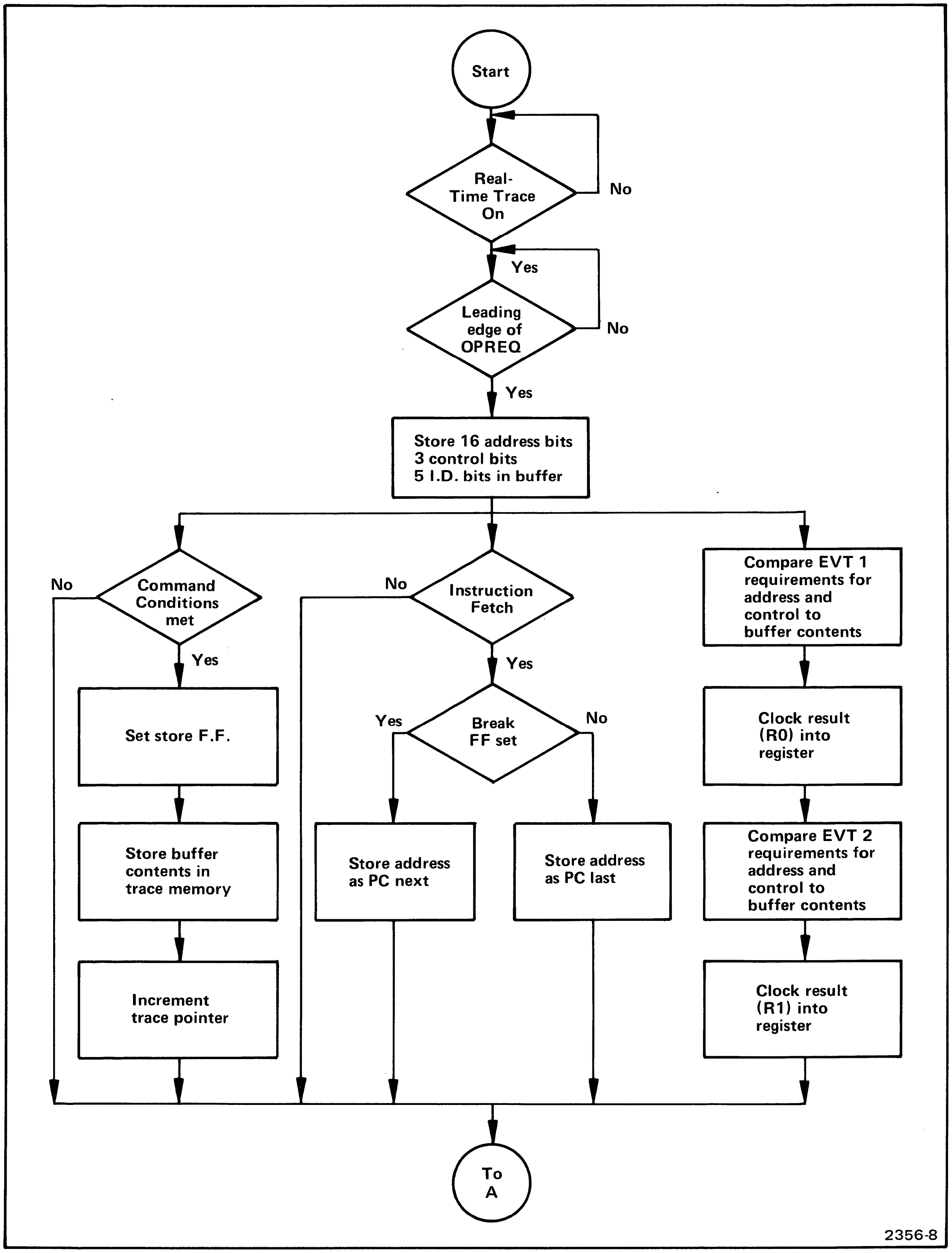


Fig. 2-6. Real-Time Trace, Event Comparison, and Pass and Delay Flow Chart.

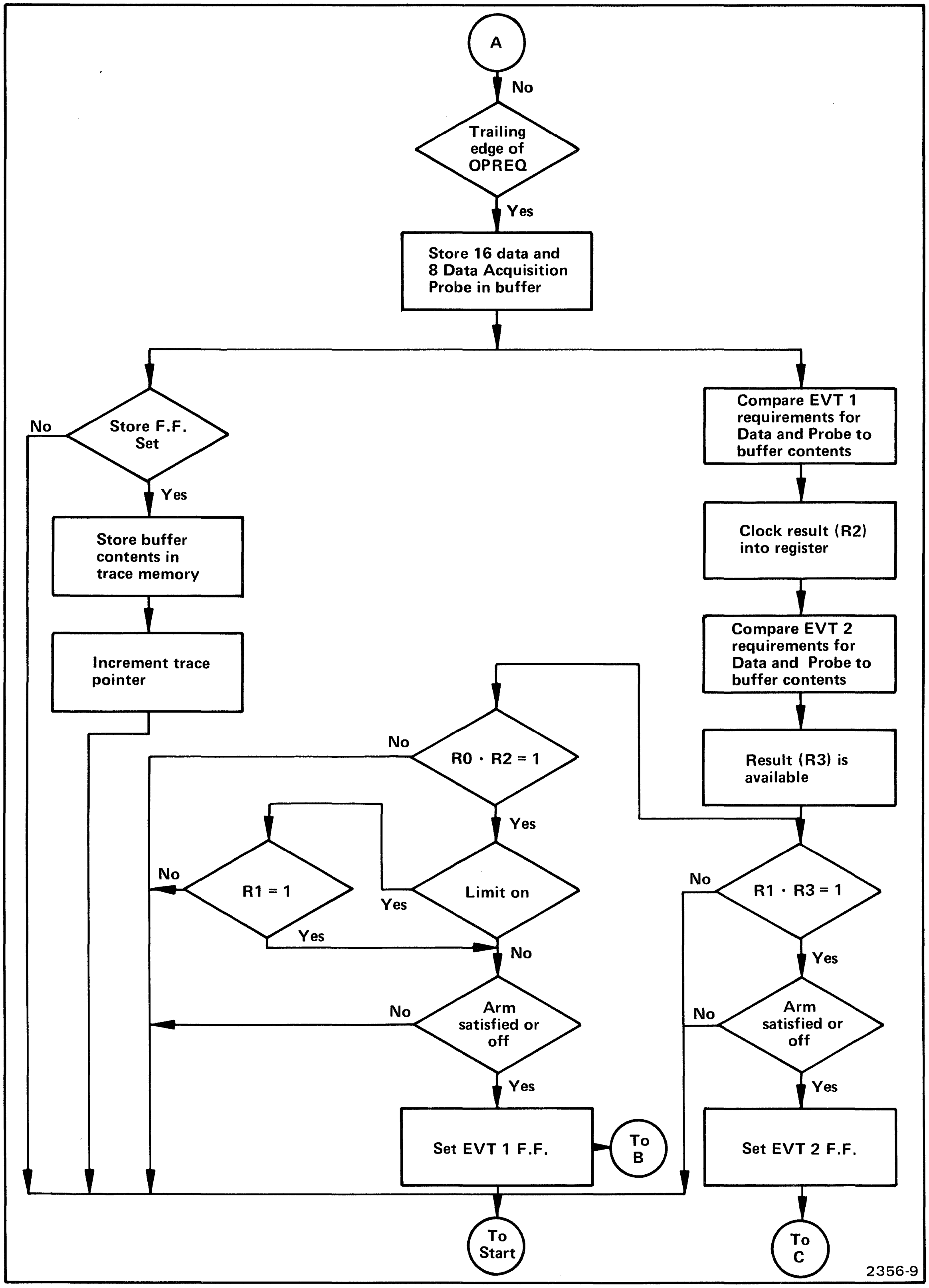


Fig. 2-7. Real-Time Trace, Event Comparison, and Pass and Delay Flow Chart.

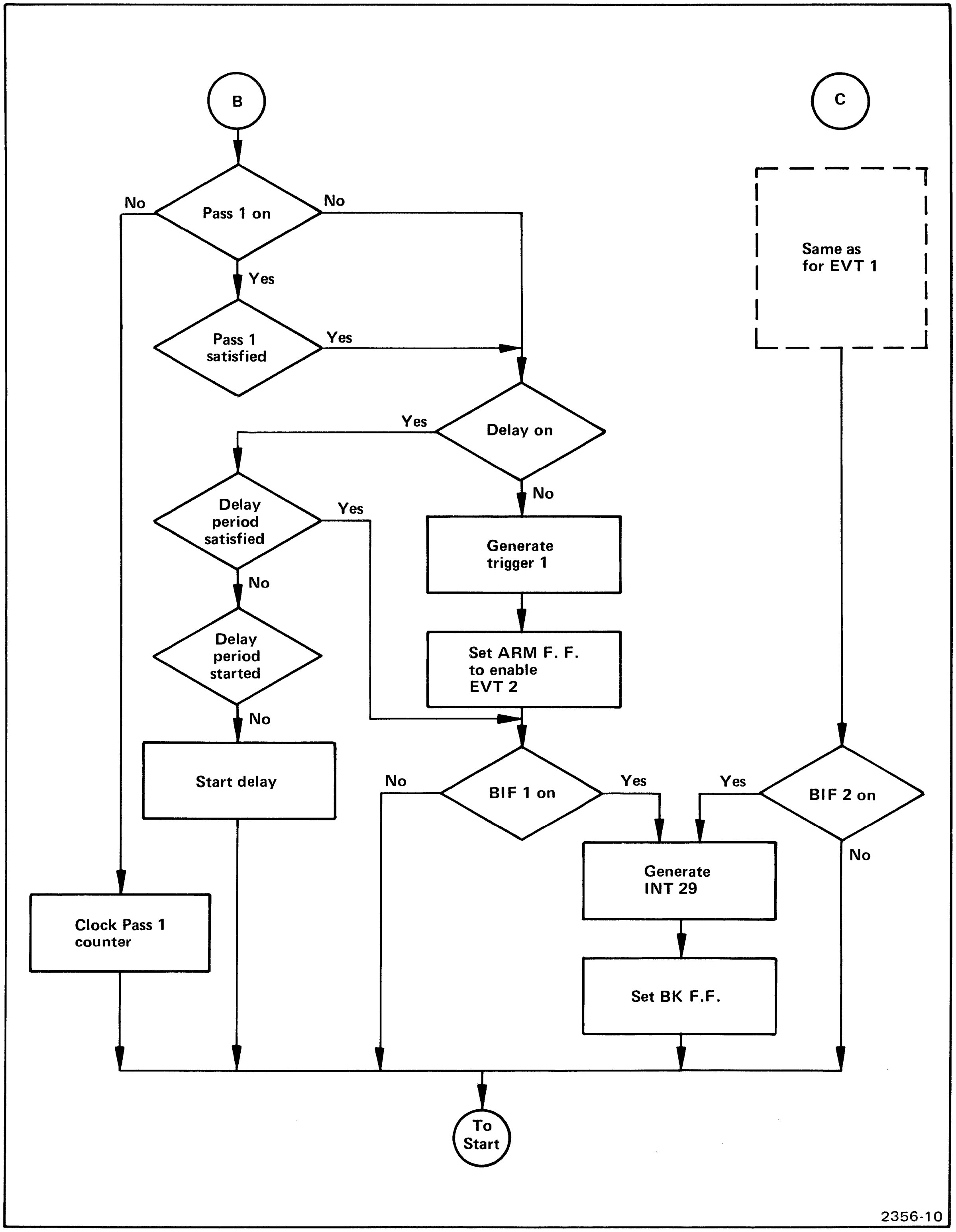


Fig. 2-8. Real-Time Trace, Event Comparison, and Pass and Delay Flow Chart.

1f) Concurrent with step 1e, the three control bits are independently compared with the requirement file.

1g) The result of step 1e and step 1f is masked (ANDED bit by bit) by the EVT 1 bus operation mask.

1h) The unmasked magnitude comparator outputs are gated into a result register 100 ns following the trailing edge of SLV OPREQ. The stored result is labeled R0.

Two

2a) All requirement files access their 01 register. This provides the EVT 2 data, masks, and logical requirements.

2b) Steps 1f and 1g are repeated for EVT 2.

2c) The unmasked comparator outputs are allowed to gate into the result register as R1.

Three

3a) Upon the trailing edge of OPREQ, 16 bus data bits and the Data Acquisition Probe data bits are loaded into the input multiplexer storage register.

3b) All comparator files access their 10 register. This address provides EVT 1 bus data, Data Acquisition Probe data, and Data Acquisition Probe mask requirements.

3c) The 16 bit magnitude comparator now compares the input data with the requirement data.

3d) Concurrent with step 3c, the Data Acquisition Probe data is compared with the event comparator file.

3e) The result of step 3e and step 3d is masked by the EVT 1 Probe mask.

3f) The unmasked Probe information and selected bus data are ANDed then shifted into the result register as R2.

Four

4a) The same sequence of events take place for EVT 2 bus data and Data Acquisition Probe data. The result is shifted into the result register as R3.

4b) The stored R0 (EVT 1 address and control bit comparison) and stored R2 (EVT 1 data and Data Acquisition Probe information) are ANDed to form the input to the EVT 1 flip-flop. If the LIMit requirements is on, R1 (EVT 2 address and Control bits) will also be ANDed with R0 and R2 for EVT 1. The input is sampled approximately 220 ns after the trailing edge of every SLV OPREQ.

4c) At the same time step 4b is occurring, R1 (EVT 2 address and control information) and R3 (EVT 2 data and Data Acquisition Probe information) are ANDed to form the input to the EVT 2 flip-flop. This input is sampled at the same time the input to the EVT 1 flip-flop is sampled.

If the ARM requirement (see the 8002 μProcessor Lab System User's Manual) is on, the Arm flip-flop must be reset. EVT RST is generated on the next bus cycle, resetting both event F.F.s.

PASS AND DELAY COUNTER

A pass and delay counter is located between the event comparator circuitry and the trigger/breakpoint output circuitry. (See the block diagram, Figure 2-9.) The purpose of the counter is to provide a programmable delay between the realization of an event comparison and the output of an event trigger pulse and/or breakpoint. A flow chart illustration of the pass count and delay operation is shown in Figure 2-8.

The delaying factor may consist of a number of variables:

1) The delay between event occurance and generation of a trigger/breakpoint may be counted in real-time (milliseconds or microseconds).

2) The delay can be made up of program clock pulses.

3) A pass counter may be utilized for delay, by counting the number of reoccurrences of a specified event, bus transaction, or instruction.

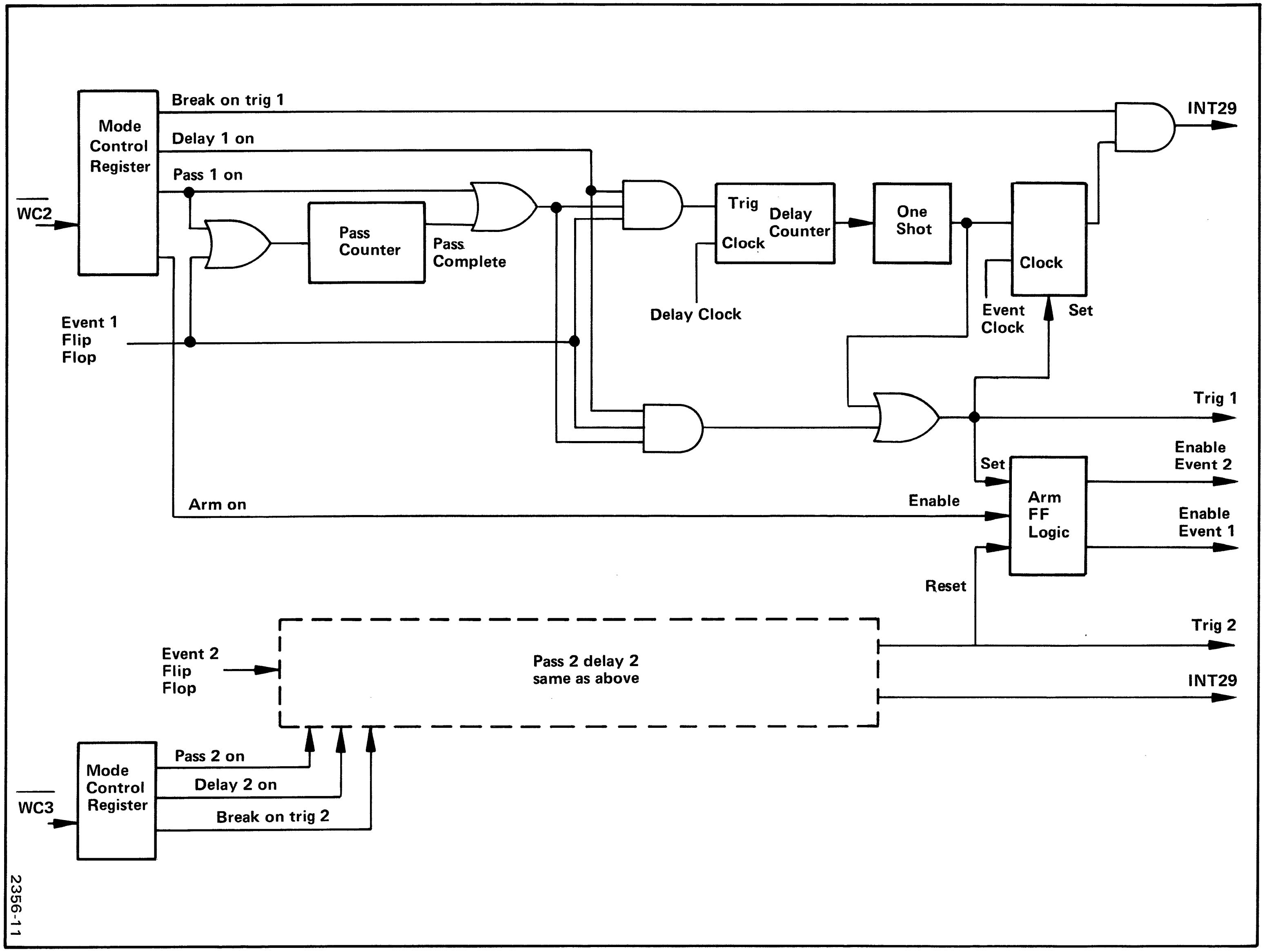


Fig. 2-9. Pass and Delay Counter Block Diagram.

Pass and Delay Circuitry

Once an event is detected by the event comparison circuitry, a trigger may be generated immediately. It may be desirable however, to delay the generation of the trigger. The delay could include a pass count requirement. The Real-Time Prototype Analyzer has the ability to count up to 65k reoccurrances (passes) of an event before releasing a trigger.

Another delay factor can be time. A delay between an event and a trigger can consist of up to 64k clock signals. The clock signals may be instruction fetch signals, bus cycles, the Emulator Processor clock, trace stores, or real-time milliseconds or microseconds. The selection of the clock to be used is software controlled and may be selected by the user.

Both pass count and time delay requirements may be specified at the same time. If both are selected, the pass count is satisfied first.

The System Processor module accesses ports $C2_{16}$ and $C3_{16}$ to set up pass count and delay requirements within the two 16 bit counters (8253). These counters are used for delay and pass count operation.

If both pass count and delay functions are off, an EVT 1 or EVT 2 signal directly generates a trigger output.

If the pass count function is on, a trigger output is inhibited until the required number of events have occurred.

In the delay mode, the pass and delay counter is set to a predetermined number. When the event occurs, the counter is decremented by a software selected clock. When zero is reached, a monostable multivibrator generates a trigger output.

FAULT DETECTION

The Real-Time Trace module fault detection circuitry notifies the remainder of the 8001/8002 μProcessor Lab when the active Emulator Processor has a problem. This circuitry detects and acts upon two different problems: 1) failure to relinquish the bus upon command, and 2) an Emulator Processor clock failure.

A mono-stable multivibrator constantly monitors three lines on the μProcessor Lab motherboard bus (SLV PSE, RUN, MST RUN). If the active Emulator Processor does not pause within .5 seconds of a command to do so, the Real-Time Prototype Analyzer sets the Emulator Processor inactive, and forces it off the bus. The system software is then notified of the fault.

The Emulator Processor clock is also monitored by the Real-Time Prototype Analyzer. Should the clock fail, a non-stable multivibrator is toggled, which notifies the System Processor of the fault.

DATA ACQUISITION PROBE

The Data Acquisition Probe is an active nine channel logic information gathering device. The Data Acquisition Probe circuitry consists of two hybrid circuits that comprise nine low-gain FET amplifiers with differential ECL outputs. The nine Probe input channels have a characteristic input impedance of 1 megohm.

Variable input threshold voltages allow the Data Acquisition Probe to be used with ECL, TTL, or MOS circuitry. The threshold voltages used are supplied by the Data Acquisition Interface of the Real-Time Prototype Analyzer. The nine signal leads and one ground lead connect to the Probe head. One signal lead is dedicated to clock information with the remaining eight used for data gathering.

More complete information on the Data Acquisition Probe may be found in the data sheet received with the Probe.

DATA ACQUISITION INTERFACE

The Data Acquisition Interface is the interface element between the active Data Acquisition Probe and the Real-Time Trace module. Data from the Probe's eight information channels is buffered and latched by the Probe to the Data Acquisition Interface. The Data Acquisition Interface translates the information from an ECL level to a TTL level. The information is then sent via a 26 connector ribbon cable to the Real-Time Trace module.

Another function of the Data Acquisition Interface is to provide an output for the dual event comparators located on the Real-Time Trace module. The Trigger 1 and Trigger 2 signals from the Real-Time Trace module are brought to the Interface by the ribbon cable. At this point, Trigger 1 and Trigger 2 are inverted and presented to two BNC connectors at a characteristic impedance of 50 ohms.

The Data Acquisition Probe attaches to the Data Acquisition Interface at a connector on the rear panel of the 8001/8002 μProcessor Lab (see Figure 2-10). The Interface panel mounts flush with the μProcessor Lab rear panel. This allows access to all the controls and input/output connectors.

Data Acquisition Interface Panel Description

The Data Acquisition Interface panel is illustrated in Figure 2-10. Centrally located on the panel is a 25 pin connector for the Data Acquisition Probe. Two BNC plugs are located on the lower portion of the panel and output Trigger 1 and Trigger 2 pulses. In the upper left-hand corner of the panel is a clock polarity switch. This switch selects either the rising or falling edge of the incoming clock signal to latch Probe data within the Interface.

Next to the clock polarity switch is the threshold level switch. This switch allows the operator to select the input threshold voltage for the Data Acquisition Probe. In the upper position, the input threshold level for all eight data channels is variable (+10 volts) and may be selected by the operator. In the middle position, input channels 0 through 3 are variable, while channels 4 through 7 are preset at a TTL level (+1.4 volts). The lower position of the switch presets the input threshold voltages for all channels to a TTL level.

The upper right side of the Data Acquisition Interface panel contains the variable threshold adjustment control and monitor. The monitor jack allows the operator to monitor the variable threshold voltage while adjusting it.

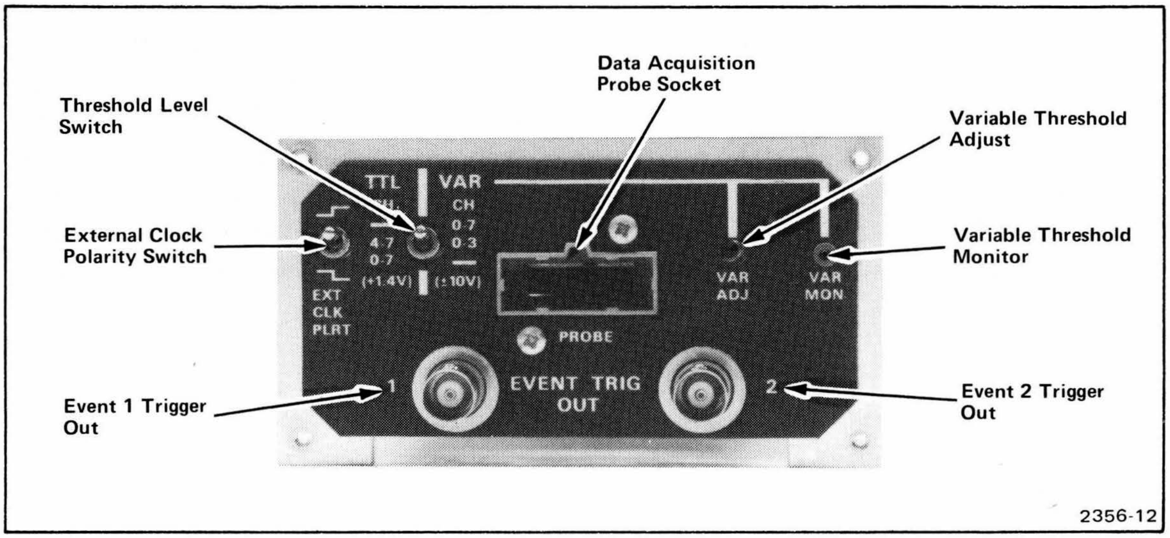


Fig. 2-10. Data Acquisition Interface Panel.

Data Acquisition Interface Circuit Description

Refer to Figure 2-11 while reading the following text.

The Data Acquisition Interface performs the following functions:

1) Translates the incoming Data Acquisition Probe ECL level signals to TTL levels.
2) Provides event trigger outputs.
3) Provides the threshold voltages for the Data Acquisition Probe.
4) Provides the ability to adjust the variable threshold voltage.
5) Provides a monitor jack to monitor the variable threshold voltage levels.

Incoming data channels 0 through 7 from the Data Acquisition Probe enter a differential line receiver/ECL to TTL translator (10125). A termination network is utilized to maintain signal integrity. The signals are received, the levels are translated, and then passed to a D type flip-flop. The clock signal from the prototype instrument under test is utilized to clock the signals through the flip-flop. The signals are then presented to the Real-Time Trace module via a 26 lead ribbon cable.

Two Schottky 50 ohm line drivers (74S140) are provided for the event trigger outputs.

Plus and minus 12 Vdc from the μProcessor Lab motherboard bus is provided to generate the required threshold voltages for the Data Acquisition Probe. An on-board −5 volt regulator reduces the −12 volts from the motherboard to provide −5 Vdc. One half a dual 741 operational amplifier provides a stable threshold voltage reference for the Data Acquisition Probe circuitry.

A jumper located on the Data Acquisition Interface board allows the clock input from the Data Acquisition Probe to be set to the same threshold level as either channels 0 through 3 or channels 4 through 7.

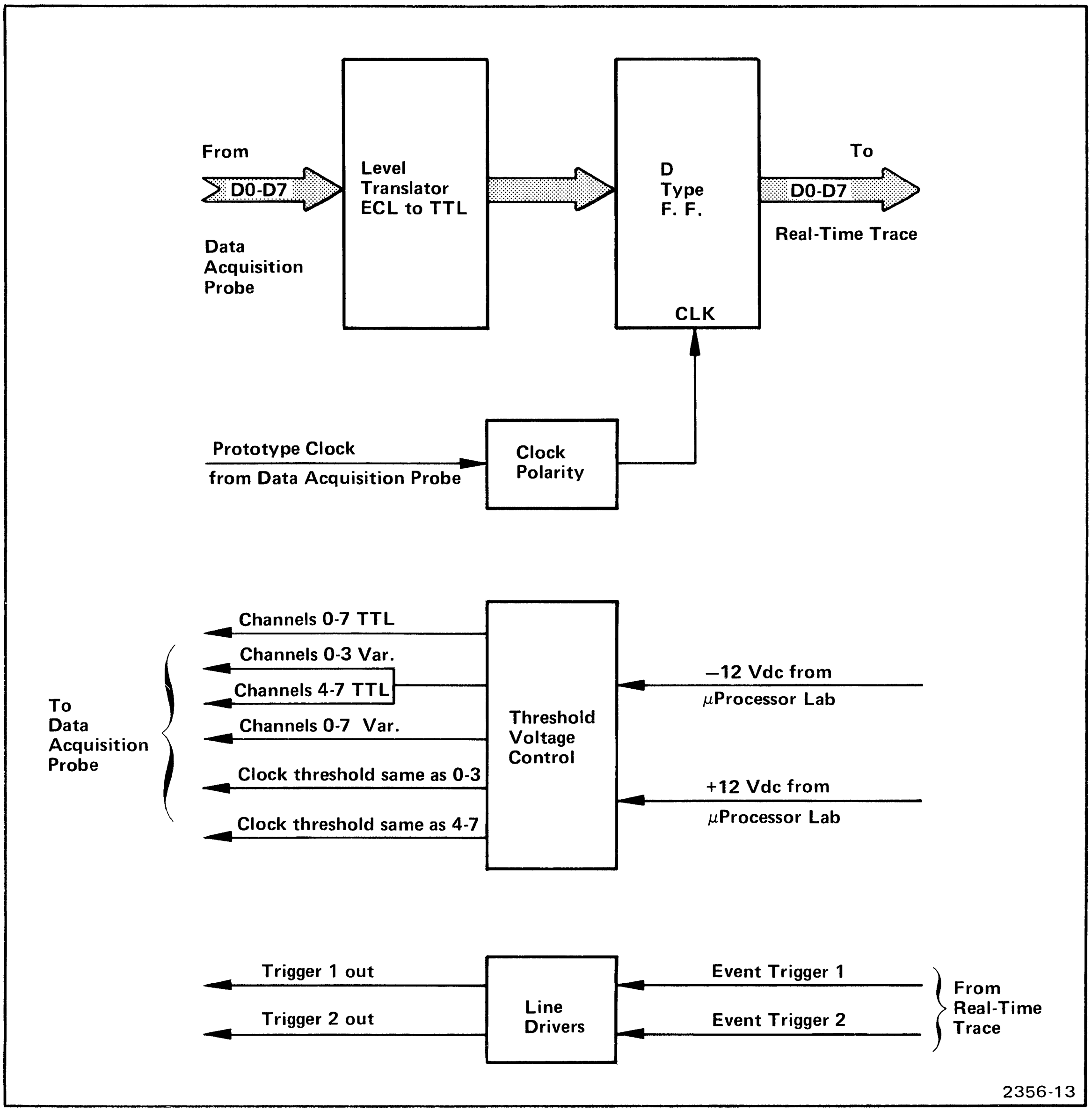


Fig. 2-11. Data Acquisition Interface Block Diagram.

Section 3
CONTROL, DATA, AND STATUS BYTES

INTRODUCTION

This section explains in detail the function and organization of the status, data and control bytes used in conjunction with the Real-Time Prototype Analyzer. The presence of a control or status byte on the 8001/8002 μProcessor Lab data bus is normally indicated by the simultaneous presence of a specific address on the address bus. In some cases the condition of a particular dedicated control line in conjunction with an address indicates a control or status byte.

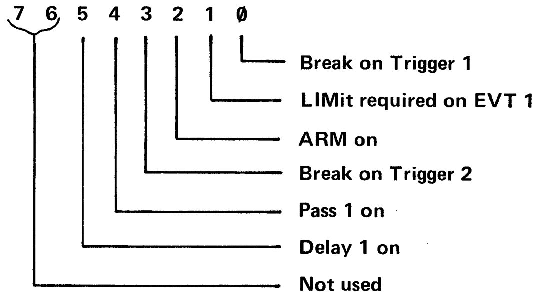
The following bytes are explained:

1) Breakpoint Mode bytes
2) Trace Control byte
3) Comparison File
4) Logical Requirements File
5) Trace Data bytes
6) Status byte

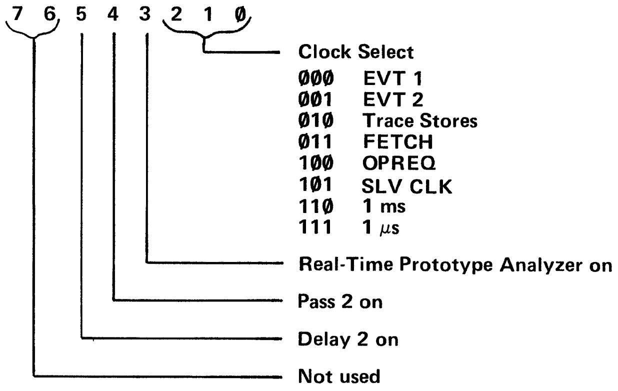
BREAKPOINT MODE BYTES (write $C2_{16}$, write $C3_{16}$)

The two breakpoint mode bytes control the breakpoint parameters of the Real-Time Prototype Analyzer.

(C2)

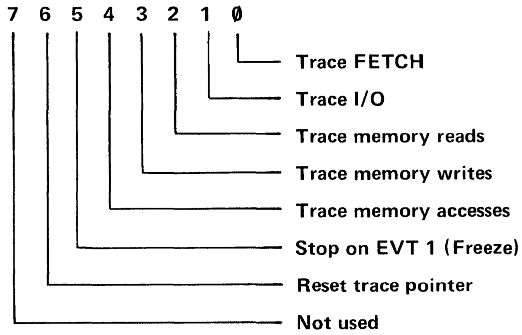


(C3)



TRACE CONTROL BYTE (write to port $C1_{16}$)

Trace control byte allows the System Processor to indicate which bus transactions will be traced (stored) by the Real-Time Trace Module. The configuration of the trace control byte is as follows:



COMPARISON FILE (Write to port $C4_{16}$)

A write to port $C4_{16}$ allows the System Processor to load the comparison file on the Real-Time Trace module with comparison data, address, control bits, Data Acquisition Probe data, and Probe and control bit mask bits. Once loaded, the information can be compared with incoming new data. The bytes are loaded in sequence and contain the following information.

Byte		Contents
0	7 6 5 4 3 2 1 0	Low order bits of address (EVT 1) negative true
1	7 6 5 4 3 2 1 0	Low order bits of address (EVT 2) negative true
2	7 6 5 4 3 2 1 0	Low roder bit of data (EVT 1) negative true
3	7 6 5 4 3 2 1 0	Low order bits of data (EVT 2) negative true
4	7 6 5 4 3 2 1 0	High order bits of address (EVT 1) negative true
5	7 6 5 4 3 2 1 0	High order bits of address (EVT 2) negative true
6	7 6 5 4 3 2 1 0	High order bits of data (EVT 1) negative true
7	7 6 5 4 3 2 1 0	High order bits of data (EVT 2) negative true
8	0	M/IO (EVT 1)
	1	R/W (EVT 1)
	2	FETCH (EVT 1)
	7 6 5 4 3	Identification Code (EVT 1)

Byte		Contents
9	0	M/IO (EVT 2)
	1	R/W (EVT 2)
	2	FETCH (EVT 2)
	3	Spare
	7 6 5 4	Not used
10	7 6 5 4 3 2 1 0	Data Acquisition Probe data EVT 1 negative true
11	7 6 5 4 3 2 1 0	Data Acquisition Probe data EVT 2 negative true
12	0	M/IO Mask (EVT 1)
	1	R/W Mask (EVT 1)
	2	FETCH Mask (EVT 1)
	7 6 5 4 3	Must be 0
13	0	M/IO Mask (EVT 2)
	1	R/W Mask (EVT 2)
	2	FETCH Mask (EVT 2)
	7 6 5 4 3	Must be 0
14	7 6 5 4 3 2 1 0	Data Acquisition Probe Mask EVT 1 positive true
15	7 6 5 4 3 2 1 0	Data Acquisition Probe Mask EVT 1 positive true

NOTE: All Masks

0 = Don't Care

1 = Must Match

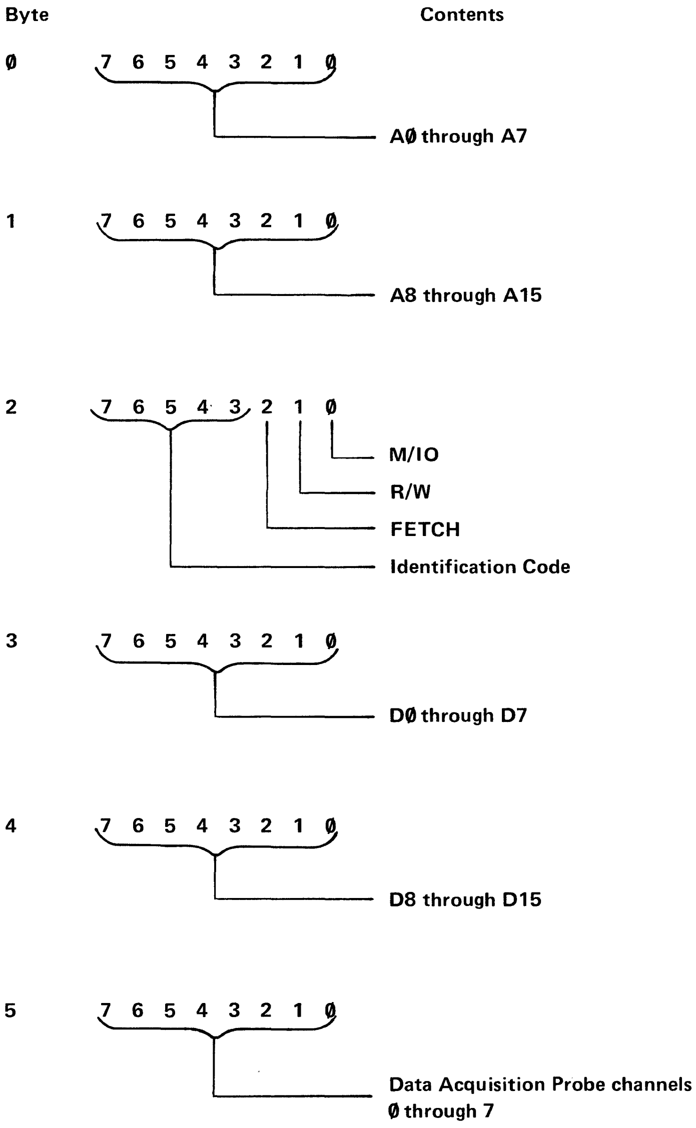
LOGICAL REQUIREMENT FILE (Write to port $C7_{16}$)

A write to port $C7_{16}$ allows the System Processor to load the logical requirements for an event comparison operation. The logical requirements for results R0, R1, R2, and R3 are loaded sequentially and contain the following information:

Byte		Contents
0	7 6 5 4 3 2 1 0	(R0)
	0	Bus address > = EVT 1 required address
	1	8 bus address = EVT 1 required 8 addresses
	2	16 bus address = EVT 1 required 16 addresses
	3	Bus address < = EVT 1 required address
	7 6 5 4	Not used
1	7 6 5 4 3 2 1 0	(R1)
	0	Bus address > = EVT 2 required address
	1	8 bus address = EVT 2 required 8 address
	2	16 bus address = EVT 2 required 16 address
	3	Bus address < = EVT 2 required address
	7 6 5 4	Not used
2	7 6 5 4 3 2 1 0	(R2)
	0	Bus data > = EVT 1 required data
	1	8 bus data = EVT 1 required 8 data
	2	16 bus data = EVT 1 required 16 data
	3	Bus data < = EVT 1 required data
	7 6 5 4	Not used
		(Data Acquisition Probe EVT 1 always required)
3	7 6 5 4 3 2 1 0	(R3)
	0	Bus data > = EVT 2 required data
	1	8 bus data = EVT 2 required 8 data
	2	16 bus data = EVT 2 required 16 data
	3	Bus data < = EVT 2 required data
	7 6 5 4	Not used
		(Data Acquisition Probe EVT 2 always required)

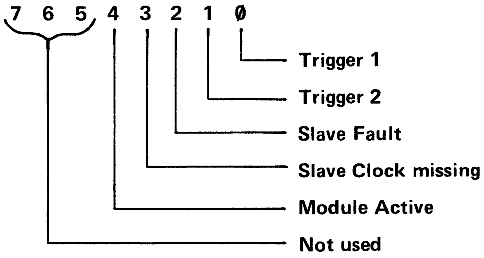
TRACE DATA BYTES (Read from port $C1_{16}$)

Information stored in the Real-Time Prototype Analyzer trace memory may be read by the System Processor. Six bytes are read consecutively for each bus transaction starting with the oldest stored information. This read sequence repeats 128 times. Byte organization is as follows:



STATUS BYTE (Read $C2_{16}$)

The status byte contains trigger and fault information determined by the Real-Time Prototype Analyzer.



REPLACEABLE ELECTRICAL PARTS

PARTS ORDERING INFORMATION

Replacement parts are available from or through your local Tektronix, Inc. Field Office or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, to include the following information in your order: Part number, instrument type or number, serial number, and modification number if applicable.

If a part you have ordered has been replaced with a new or improved part, your local Tektronix, Inc. Field Office or representative will contact you concerning any change in part number.

Change information, if any, is located at the rear of this manual.

SPECIAL NOTES AND SYMBOLS

X000	Part first added at this serial number
00X	Part removed after this serial number

ITEM NAME

In the Parts List, an Item Name is separated from the description by a colon (:). Because of space limitations, an Item Name may sometimes appear as incomplete. For further Item Name identification, the U.S. Federal Cataloging Handbook H6-1 can be utilized where possible.

ABBREVIATIONS

ACTR	ACTUATOR	PLSTC	PLASTIC
ASSY	ASSEMBLY	QTZ	QUARTZ
CAP	CAPACITOR	RECP	RECEPTACLE
CER	CERAMIC	RES	RESISTOR
CKT	CIRCUIT	RF	RADIO FREQUENCY
COMP	COMPOSITION	SEL	SELECTED
CONN	CONNECTOR	SEMICOND	SEMICONDUCTOR
ELCTLT	ELECTROLYTIC	SENS	SENSITIVE
ELEC	ELECTRICAL	VAR	VARIABLE
INCAND	INCANDESCENT	WW	WIREWOUND
LED	LIGHT EMITTING DIODE	XFMR	TRANSFORMER
NONWIR	NON WIREWOUND	XTAL	CRYSTAL

CROSS INDEX—MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip
000CR	MILLENNIUM INFORMATION SYSTEMS, INC.	19020 PRUNERIDGE AVENUE	CUPERTINO, CA 95014
00853	SANGAMO ELECTRIC CO., S. CAROLINA DIV.	P O BOX 128	PICKENS, SC 29671
01121	ALLEN-BRADLEY COMPANY	1201 2ND STREET SOUTH	MILWAUKEE, WI 53204
01295	TEXAS INSTRUMENTS, INC., SEMICONDUCTOR GROUP	P O BOX 5012, 13500 N CENTRAL EXPRESSWAY	DALLAS, TX 75222
02111	SPECTROL ELECTRONICS CORPORATION	17070 EAST GALE AVENUE	CITY OF INDUSTRY, CA 91745
04713	MOTOROLA, INC., SEMICONDUCTOR PROD. DIV.	5005 E MCDOWELL RD,PO BOX 20923	PHOENIX, AZ 85036
07263	FAIRCHILD SEMICONDUCTOR, A DIV. OF FAIRCHILD CAMERA AND INSTRUMENT CORP.	464 ELLIS STREET	MOUNTAIN VIEW, CA 94042
07910	TELEDYNE SEMICONDUCTOR	12515 CHADRON AVE.	HAWTHORNE, CA 90250
09353	C AND K COMPONENTS, INC.	103 MORSE STREET	WATERTOWN, MA 02172
18324	SIGNETICS CORP.	811 E. ARQUES	SUNNYVALE, CA 94086
27014	NATIONAL SEMICONDUCTOR CORP.	2900 SEMICONDUCTOR DR.	SANTA CLARA, CA 95051
32997	BOURNS, INC., TRIMPOT PRODUCTS DIV.	1200 COLUMBIA AVE.	RIVERSIDE, CA 92507
34335	ADVANCED MICRO DEVICES	901 THOMPSON PL.	SUNNYVALE, CA 94086
34649	INTEL CORP.	3065 BOWERS AVE.	SANTA CLARA, CA 95051
56289	SPRAGUE ELECTRIC CO.		NORTH ADAMS, MA 01247
71785	TRW, CINCH CONNECTORS	1501 MORSE AVENUE	ELK GROVE VILLAGE, IL 60007
72982	ERIE TECHNOLOGICAL PRODUCTS, INC.	644 W. 12TH ST.	ERIE, PA 16512
80009	TEKTRONIX, INC.	P O BOX 500	BEAVERTON, OR 97077
91637	DALE ELECTRONICS, INC.	P. O. BOX 609	COLUMBUS, NE 68601
91836	KINGS ELECTRONICS CO., INC.	40 MARBLEDALE ROAD	TUCKAHOE, NY 10707

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
A46	670-5217-00			CKT BOARD ASSY:REAL TIME TRACE	80009	670-5217-00
C1013	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C1047	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C1078	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C1097	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C1122	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C1135	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C1139	283-0676-00			CAP.,FXD,MICA D:82PF,1%,500V	00853	D105E820F0
C1146	283-0782-00			CAP.,FXD,MICA DI:39PF,+/-5%,500V	00853	D155E390J
C1167	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C2014	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C2028	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C2039	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C2049	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C2068	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C2078	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C2089	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C2117	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C2129	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C2166	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C2175	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C3014	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C3047	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C3068	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C3077	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C3109	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C3128	283-0676-00			CAP.,FXD,MICA D:82PF,1%,500V	00853	D105E820F0
C3138	283-0782-00			CAP.,FXD,MICA DI:39PF,+/-5%,500V	00853	D155E390J
C3171	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C4015	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C4059	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C4078	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C4108	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C4127	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C4145	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C4147	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C5019	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C5028	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C5058	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C5079	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C5119	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C5136	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C5149	283-0676-00			CAP.,FXD,MICA D:82PF,1%,500V	00853	D105E820F0
C5159	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C5164	283-0594-00			CAP.,FXD,MICA D:0.001UF,1%,100V	00853	D151F102F0
C5167	290-0209-00			CAP.,FXD,ELCTLT:50UF,+75-10%,25V	56289	30D688
C5179	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C6022	290-0209-00			CAP.,FXD,ELCTLT:50UF,+75-10%,25V	56289	30D688
C6035	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C6142	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
CR6162	152-0233-00			SEMICOND DEVICE:SILICON,85V,100MA	80009	152-0233-00

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
DL3160	----- -----			DELAY LINE,200NS:10 TAP	000CR	5207 0460
R1015	315-0201-00			RES.,FXD,CMPSN:200 OHM,5%,0.25W	01121	CB2015
R1017	315-0331-00			RES.,FXD,CMPSN:330 OHM,5%,0.25W	01121	CB3315
R1068	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R1088	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R1137	321-0260-00			RES.,FXD,FILM:4.99K OHM,1%,0.125W	91637	MFF1816G49900F
R1148	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R2172	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R3127	321-0305-00			RES.,FXD,FILM:14.7K OHM,1%,0.125W	91637	MFF1816G14701F
R3137	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R3158	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R3164	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R4068	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R4097	315-0271-00			RES.,FXD,CMPSN:270 OHM,5%,0.25W	01121	CB2715
R4107	315-0271-00			RES.,FXD,CMPSN:270 OHM,5%,0.25W	01121	CB2715
R4146	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R4158	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R4169	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R4173	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R5077	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R5106	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R5148	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R5172	321-0335-00			RES.,FXD,FILM:30.1K OHM,1%,0.125W	91637	MFF1816G30101F
R6143	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R6144	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R6152	315-0473-00			RES.,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
RP1037	307-0594-00			RES.,NTWK,FXD FI:7,220 OHM,2%,1.0W	32997	4308R-101-221
RP1039	307-0598-00			RES.,NTWK,FXD FI:7,330 OHM,2%,1.0W	32997	4308R-101-331
RP5068	307-0596-00			RES.,NTWK,FXD FI:7,2.2K OHM,2%,1.0W	32997	4308R-101-222
U1010	156-0707-00			MICROCIRCUIT DI:QUAD 2 INP EXCL OR GATE	27014	DM74S86N
U1020	156-1045-00			MICROCIRCUIT DI:OCTAL D TYPE EDGE TRIG FF	80009	156-1045-00
U1030	156-1045-00			MICROCIRCUIT DI:OCTAL D TYPE EDGE TRIG FF	80009	156-1045-00
U1040	156-0989-00			MICROCIRCUIT DI:4 X 4 RGTR FILE W/3 STATE OUT	01295	SN74LS760N
U1050	156-0989-00			MICROCIRCUIT DI:4 X 4 RGTR FILE W/3 STATE OUT	01295	SN74LS760N
U1080	156-0989-00			MICROCIRCUIT DI:4 X 4 RGTR FILE W/3 STATE OUT	01295	SN74LS760N
U1070	156-0989-00			MICROCIRCUIT DI:4 X 4 RGTR FILE W/3 STATE OUT	01295	SN74LS760N
U1060	156-0989-00			MICROCIRCUIT DI:4 X 4 RGTR FILE W/3 STATE OUT	01295	SN74LS760N
U1090	156-1036-00			MICROCIRCUIT DI:PROGRAMMABLE INTERVAL TIMER	80009	156-1036-00
U1110	156-1036-00			MICROCIRCUIT DI:PROGRAMMABLE,INTERVAL TIMER	80009	156-1036-00
U1120	156-0690-00			MICROCIRCUIT DI:QUAD 2-INP NOR GATE	27014	DM74S02N
U1130	156-0323-00			MICROCIRCUIT,DI:HEX. INVERTER	01295	SN74S04N
U1140	156-0405-00			MICROCIRCUIT,DI:DUAL RETRIG MONOSTABLE MV	07263	9602PC
U1150	156-0994-00			MICROCIRCUIT,DI:8 INPUT DATA SEL/MUX	01295	SN74LS151N
U1160	156-0948-00			MICROCIRCUIT,DI:QUAD D FLIP-FLOP	01295	SN74S175J
U1170	156-0180-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN74S00N
U2010	156-0303-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	07263	9S03DC
U2020	156-0698-00			MICROCIRCUIT,DI:256 X 4 STATIC RAM	34649	B2101A-4
U2030	156-0698-00			MICROCIRCUIT,DI:256 X 4 STATIC RAM	34649	B2101A-4
U2040	156-0698-00			MICROCIRCUIT,DI:256 X 4 STATIC RAM	34649	B2101A-4
U2050	156-0698-00			MICROCIRCUIT,DI:256 X 4 STATIC RAM	34649	B2101A-4
U2060	156-0698-00			MICROCIRCUIT,DI:256 X 4 STATIC RAM	34649	B2101A-4
U2070	156-0698-00			MICROCIRCUIT,DI:256 X 4 STATIC RAM	34649	B2101A-4

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
U2080	156-1044-00			MICROCIRCUIT DI:4 BIT SYNC CNTR W/CLEAR	80009	156-1044-00
U2090	156-1044-00			MICROCIRCUIT DI:4 BIT SYNC CNTR W/CLEAR	80009	156-1044-00
U2100	156-0998-00			MICROCIRCUIT INTFC:HIGH SPEED HEX 3-STATE BFR	18324	MC6887/MC8T97L
U2110	156-0998-00			MICROCIRCUIT,INTFC:HIGH SPEED HEX 3-STATE BFR	18324	MC6887/MC8T97L
U2120	156-0385-00			MICROCIRCUIT,DI:HEX.INVERTER	01295	SN74LS04N
U2130	156-0321-00			MICROCIRCUIT,DI:TRIPLE 3-INPUT NAND GATE	01295	SN74S10N
U2140	156-0180-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN74S00N
U2150	156-0118-00			MICROCIRCUIT,DI:J-K MASTER-SLAVE FLIP-FLOP	01295	SN74S112N
U2160	156-0321-00			MICROCIRCUIT,DI:TRIPLE 3-INPUT NAND GATE	01295	SN74S10N
U2170	156-0118-00			MICROCIRCUIT,DI:J-K MASTER-SLAVE FLIP-FLOP	01295	SN74S112N
U3010	156-0989-00			MICROCIRCUIT DI:4 X 4 RGTR FILE W/3 STATE OUT	01295	SN74LS760N
U3020	156-0989-00			MICROCIRCUIT DI:4 X 4 RGTR FILE W/3 STATE OUT	01295	SN74LS760N
U3030	156-0989-00			MICROCIRCUIT DI:4 X 4 RGTR FILE W/3 STATE OUT	01295	SN74LS760N
U3040	156-0989-00			MICROCIRCUIT DI:4 X 4 RGTR FILE W/3 STATE OUT	01295	SN74LS760N
U3050	156-0989-00			MICROCIRCUIT DI:4 X 4 RGTR FILE W/3 STATE OUT	01295	SN74LS760N
U3060	156-0989-00			MICROCIRCUIT DI:4 X 4 RGTR FILE W/3 STATE OUT	01295	SN74LS760N
U3070	156-0989-00			MICROCIRCUIT DI:4 X 4 RGTR FILE W/3 STATE OUT	01295	SN74LS760N
U3080	156-0948-00			MICROCIRCUIT,DI:QUAD D FLIP-FLOP	01295	SN74S175J
U3090	156-0391-00			MICROCIRCUIT,DI:HEX LATCH WITH CLEAR	01295	SN74LS174N
U3100	156-0391-00			MICROCIRCUIT,DI:HEX LATCH WITH CLEAR	01295	SN74LS174N
U3110	156-0989-00			MICROCIRCUIT DI:4 X 4 RGTR FILE W/3 STATE OUT	01295	SN74LS760N
U3120	156-0089-00			MICROCIRCUIT,DI:4-BIT UP/DOWN COUNTER	80009	156-0089-00
U3130	156-0405-00			MICROCIRCUIT,DI:DUAL RETRIG MONOSTABLE MV	07263	9602PC
U3140	156-0693-00			MICROCIRCUIT,DI:DECODER/DEMULTIPLEXER	34335	SN74S139N
U3150	156-0180-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN74S00N
U3170	156-0323-00			MICROCIRCUIT,DI:HEX. INVERTER	01295	SN74S04N
U4010	156-0989-00			MICROCIRCUIT DI:4 X 4 RGTR FILE W/3 STATE OUT	01295	SN74LS760N
U4020	156-0303-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	07263	9S03DC
U4030	156-0707-00			MICROCIRCUIT,DI:QUAD 2 INP EXCL OR GATE	27014	DM74S86N
U4040	156-1041-00			MICROCIRCUIT,DI:4 BIT MAGNITUDE COMPARATORS	80009	156-1041-00
U4050	156-1041-00			MICROCIRCUIT,DI:4 BIT MAGNITUDE COMPARATORS	80009	156-1041-00
U4060	156-1041-00			MICROCIRCUIT,DI:4 BIT MAGNITUDE COMPARATORS	80009	156-1041-00
U4070	156-1041-00			MICROCIRCUIT,DI:4 BIT MAGNITUDE COMPARATORS	80009	156-1041-00
U4080	156-1041-00			MICROCIRCUIT,DI:4 BIT MAGNITUDE COMPARATORS	80009	156-1041-00
U4090	156-0391-00			MICROCIRCUIT,DI:HEX LATCH WITH CLEAR	01295	SN74LS174N
U4100	156-0303-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	07263	9S03DC
U4110	156-0303-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	07263	9S03DC
U4120	156-0061-00			MICROCIRCUIT,DI:SGL,BCD TO DEC DECODER	01295	SN7442N
U4130	156-0693-00			MICROCIRCUIT,DI:DECODER/DEMULTIPLEXER	34335	SN74S139N
U4140	156-0180-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN74S00N
U4150	156-0323-00			MICROCIRCUIT,DI:HEX. INVERTER	01295	SN74S04N
U4160	156-0999-00			MICROCIRCUIT,INTFC:HIGH SPEED HEX 3-STATE INV	18324	8T98F
U4170	156-0707-00			MICROCIRCUIT,DI:QUAD 2 INP EXCL OR GATE	27014	DM74S86N
U5020	156-0996-00			MICROCIRCUIT,DI:DUAL 5-INPUT NOR GATE	18324	8T26F
U5030	156-0996-00			MICROCIRCUIT,DI:DUAL 5-INPUT NOR GATE	18324	8T26F
U5040	156-1045-00			MICROCIRCUIT,DI:QUAD 2 INPUT MUX W/STORAGE	80009	156-1045-00
U5050	156-1045-00			MICROCIRCUIT,DI:QUAD 2 INPUT MUX W/STORAGE	80009	156-1045-00
U5060	156-1045-00			MICROCIRCUIT,DI:QUAD 2 INPUT MUX W/STORAGE	80009	156-1045-00
U5070	156-1045-00			MICROCIRCUIT,DI:QUAD 2 INPUT MUX W/STORAGE	80009	156-1045-00
U5080	156-0180-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN74S00N
U5090	156-0303-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	07263	9S03DC
U5100	156-0323-00			MICROCIRCUIT,DI:HEX. INVERTER	01295	SN74S04N
U5110	156-1044-00			MICROCIRCUIT,DI:4 BIT SYNC BIN CNTR W/CLEAR	80009	156-1044-00

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
U5120	156-0385-00			MICROCIRCUIT,DI:HEX.INVERTER	01295	SN74LS04N
U5130	156-0690-00			MICROCIRCUIT,DI:QUAD 2-INP NOR GATE	80009	156-0690-00
U5140	156-0035-00			MICROCIRCUIT,DI:SGL 8-INPUT POS NAND GATE	80009	156-0035-00
U5160	156-0405-00			MICROCIRCUIT,DI:DUAL RETRIG MONOSTABLE MV	07263	9602PC
U5170	156-0180-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN74S00N
U6150	156-0303-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	07263	9S03DC
U6160	156-1015-00			MICROCIRCUIT,DI:DUAL J-K EDGE TRIG FF	80009	156-1015-00
A48	670-5208-00			CIRCUIT BD ASSY:DATA ACQUISITION INTERFACE	80009	670-5208-00
C1011	283-0080-00			CAP.,FXD,CER DI:0.022UF,+80-20%,25V	56289	19C611
C1039	283-0080-00			CAP.,FXD,CER DI:0.022UF,+80-20%,25V	56289	19C611
C2011	283-0080-00			CAP.,FXD,CER DI:0.022UF,+80-20%,25V	56289	19C611
C3001	290-0745-00			CAP.,FXD,ELCTLT:22UF,+50-10%,25V	56289	502D225
C3002	283-0080-00			CAP.,FXD,CER DI:0.022UF,+80-20%,25V	56289	19C611
C3012	290-0745-00			CAP.,FXD,ELCTLT:22UF,+50-10%,25V	56289	502D225
C3015	283-0080-00			CAP.,FXD,CER DI:0.022UF,+80-20%,25V	56289	19C611
C3021	290-0746-00			CAP.,FXD,ELCTLT:47UF,+50-10%,16V	56289	502D226
C3022	283-0080-00			CAP.,FXD,CER DI:0.022UF,+80-20%,25V	56289	19C611
C3030	283-0080-00			CAP.,FXD,CER DI:0.022UF,+80-20%,25V	56289	19C611
C3031	283-0080-00			CAP.,FXD,CER DI:0.022UF,+80-20%,25V	56289	19C611
C3032	290-0746-00			CAP.,FXD,ELCTLT:47UF,+50-10%,16V	56289	502D226
C3033	283-0080-00			CAP.,FXD,CER DI:0.022UF,+80-20%,25V	56289	19C611
CR1012	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
J3	131-0274-00			CONNECTOR,RCPT,:BNC FEMALE	91836	KC79-67
J4	131-0274-00			CONNECTOR,RCPT,:BNC FEMALE	91836	KC79-67
J2000	131-1897-00			CONNECTOR,RCPT,:25 MALE CONTACT	71785	DCDA25P4C4010
R1004	315-0511-00			RES.,FXD,CMPSN:510 OHM,5%,0.25W	01121	CB5115
R1005	315-0161-00			RES.,FXD,CMPSN:160 OHM,5%,0.25W	01121	CB1615
R1006	315-0511-00			RES.,FXD,CMPSN:510 OHM,5%,0.25W	01121	CB5115
R1021	307-0503-00			RES.,NTWK,THK FI:(9) 510 OHM,20%,0.125W	91637	CSP10E01511M
R1023	315-0161-00			RES.,FXD,CMPSN:160 OHM,5%,0.25W	01121	CB1615
R1024	315-0161-00			RES.,FXD,CMPSN:160 OHM,5%,0.25W	01121	CB1615
R1025	315-0161-00			RES.,FXD,CMPSN:160 OHM,5%,0.25W	01121	CB1615
R1026	315-0161-00			RES.,FXD,CMPSN:160 OHM,5%,0.25W	01121	CB1615
R2022	307-0503-00			RES.,NTWK,THK FI:(9) 510 OHM,20%,0.125W	91637	CSP10E01511M
R2023	315-0161-00			RES.,FXD,CMPSN:160 OHM,5%,0.25W	01121	CB1615
R2024	315-0161-00			RES.,FXD,CMPSN:160 OHM,5%,0.25W	01121	CB1615
R2025	315-0161-00			RES.,FXD,CMPSN:160 OHM,5%,0.25W	01121	CB1615
R2026	315-0161-00			RES.,FXD,CMPSN:160 OHM,5%,0.25W	01121	CB1615
R3005	311-1894-00			RES.,VAR,NONWIR:5K OHM,10%,0.75W	02111	43P-502-T601
R3006	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R3007	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R3008	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	91637	MFF1816G10000F
R3011	321-0816-00			RES.,FXD,FILM:5K OHM,1%,0.125W	91637	MFF1816G50000F
R3015	315-0392-00			RES.,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
R3017	321-0318-00			RES.,FXD,FILM:20K OHM,1%,0.125W	91637	MFF1816G20001F
R3019	308-0763-00			RES.,FXD,WW:13.7 OHM,1%,5W	91637	NS-5-K13R70F
R3021	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R3022	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R3023	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R3025	321-0816-00			RES.,FXD,FILM:5K OHM,1%,0.125W	91637	MFF1816G50000F
R3026	321-0318-00			RES.,FXD,FILM:20K OHM,1%,0.125W	91637	MFF1816G20001F
R3027	321-0816-00			RES.,FXD,FILM:5K OHM,1%,0.125W	91637	MFF1816G50000F
R3030	321-0183-00			RES.,FXD,FILM:787 OHM,1%,0.125W	91637	MFF1816G787R0F
R3035	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R3039	305-0101-00			RES.,FXD,CMPSN:100 OHM,5%,2W	01121	HB1015
R3051	315-0221-00			RES.,FXD,CMPSN:220 OHM,5%,0.25W	01121	CB2215
R3052	315-0221-00			RES.,FXD,CMPSN:220 OHM,5%,0.25W	01121	CB2215
R3053	315-0331-00			RES.,FXD,CMPSN:330 OHM,5%,0.25W	01121	CB3315
R3054	315-0331-00			RES.,FXD,CMPSN:330 OHM,5%,0.25W	01121	CB3315
S1001	260-1893-00			SWITCH,TOGGLE:DPDT,0.4A,20V,2 POS	09353	7201-AV-B
S1009	260-1894-00			SWITCH,TOGGLE:DPDT,0.4A,20V,3 POS	09353	7211-AV-B
U1010	156-0316-00			MICROCIRCUIT,DI:QUAD ECL TO TTL CONVERTER	04713	MC10125L
U1030	156-0316-00			MICROCIRCUIT,DI:QUAD ECL TO TTL CONVERTER	04713	MC10125L
U1040	156-0948-00			MICROCIRCUIT,DI:QUAD D FLIP-FLOP	01295	SN74S175J
U2030	156-0316-00			MICROCIRCUIT,DI:QUAD ECL TO TTL CONVERTER	04713	MC10125L
U2040	156-0948-00			MICROCIRCUIT,DI:QUAD D FLIP-FLOP	01295	SN74S175J
U3020	156-0158-00			MICROCIRCUIT,LI:DUAL OPERATIONAL AMPLIFIER	80009	156-0158-00
U3029	156-0846-00			MICROCIRCUIT,LI:VOLTAGE RGTR	04713	MC7905CT
U3030	156-0419-00			MICROCIRCUIT,DI:DUAL 4-INPUT,NAND GATE	01295	SN74S140N

Section 5
DIAGRAMS

Symbols and Reference Designators

Graphic symbols for electrical and logic symbols, used on the diagrams, are based on ANSI Y32.2, 1975, and ANSI Y32.14, 1973, "American National Standards Institute." Logic symbols depict the logic function of the device in positive logic. Copies of these standards can be obtained from the Institute of Electrical and Electronics Engineers, 345 East 47th Street, New York, N.Y., 11017. Exceptions and additions are shown on this sample diagram. These conform or are based on the manufacturers data sheet and industry trends.

Resistor values are in ohms, unless noted otherwise, and the Ω symbol is omitted. Capacitor values ⩽ 1 (e.g. 10) are in picofarads (pF) and values < 1 (e.g. 0.01) are in micofarads unless otherwise noted.

Component Circuit Numbers

Circuit numbers for the components (resistors, IC's, etc.) on the μProcessor Lab modules (boards) are assigned according to their physical location. Some circuit boards have a grid of alphanumeric notation screened or etched on the board. The letters denote row (horizontal) position, the numerals column (vertical) position. Circuit numbers for the schematics or other documentation convert the alpha notation to a number. The letter A converts to 1, B to 2, etc. Thus, a circuit number of R3082 denotes row C column 08; or 8 and position 2 within a box of 10 expander numbers, at row 03 column 8 location.

The following partial diagram illustrates special symbology and practices used on the diagrams with a description of the meaning.

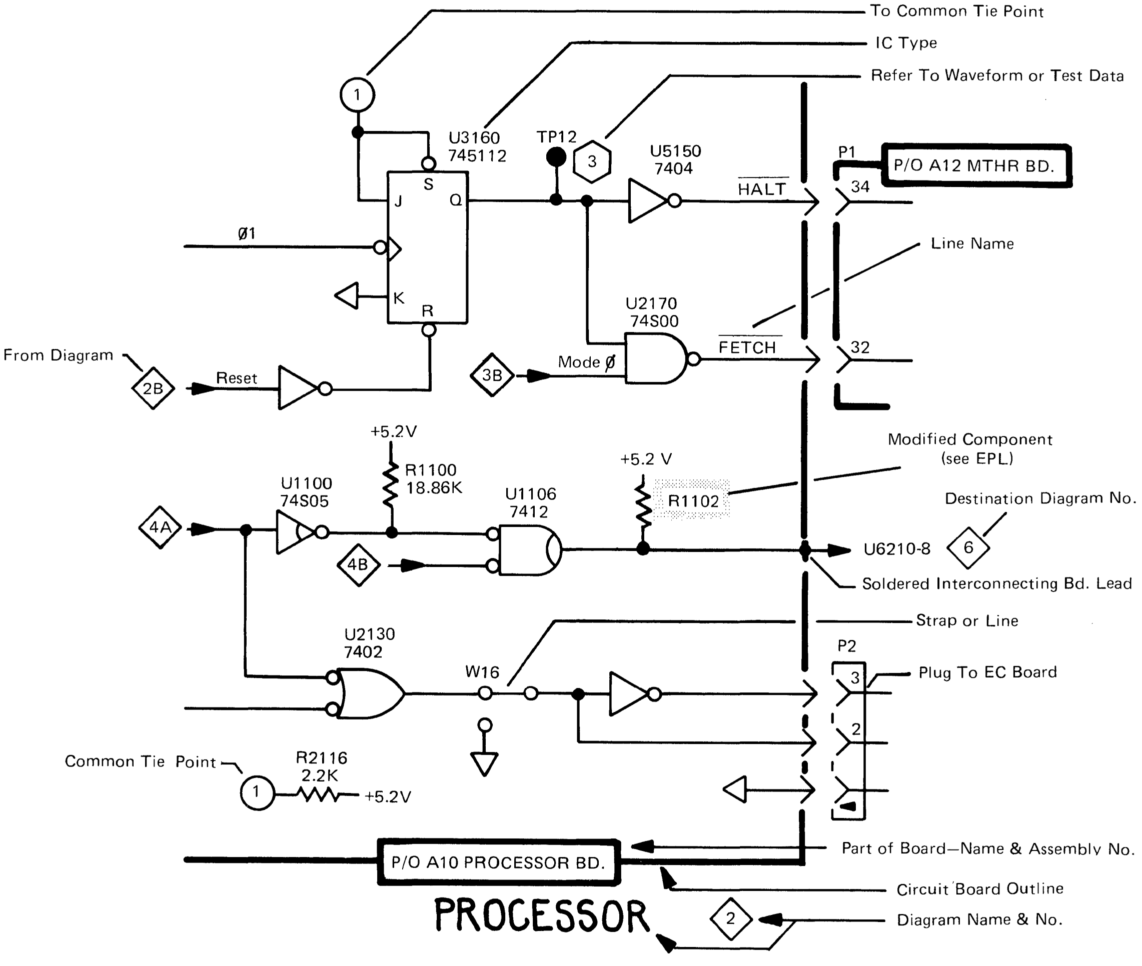


Table 5-1. IC Pin Information

Device	GND	VCC
74S00	7	14
74S00	7	14
74S00	7	14
74S00	7	14
74S00	7	14
74S02	7	14
74S02	7	14
74S03	7	14
74S03	7	14
74S03	7	14
74S03	7	14
74S03	7	14
74S03	7	14
74LS04	7	14
74LS04	7	14
74S04	7	14
74S04	7	14
74S04	7	14
74S04	7	14
74S10	7	14
74S10	7	14
7430	7	14
7442A	8	16
74S85	8	16
74S85	8	16
74S85	8	16
74S85	8	16
74S85	8	16
74S86	8	16
74S86	8	16
74S86	8	16
74109	8	16
74S112	8	16
74S112	8	16
74S112	8	16
74S139	8	16
74S139	8	16
74LS151	8	16
74LS161	8	16
74LS161	8	16
74LS161	8	16
74LS174	8	16
74LS174	8	16
74LS174	8	16
74LS175	8	16
74LS175	8	16
74193	8	16
74LS298	8	16
74LS298	8	16
74LS298	8	16
74LS298	8	16
74LS298	8	16
74LS298	8	16
74LS670	8	16
74LS670	8	16
74LS670	8	16
74LS670	8	16
74LS670	8	16
74LS670	8	16
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74LS670	8	16
74LS670	8	16
74LS670	8	16
74LS670	8	16
74LS670	8	16
74LS670	8	16
8T26	8	16
8T26	8	16
8T97	8	16
8T97	8	16
8T98	8	16
8253	12	24
8253	12	24
9602	8	16
9602	8	16
9602	8	16
2101-A2	8	22
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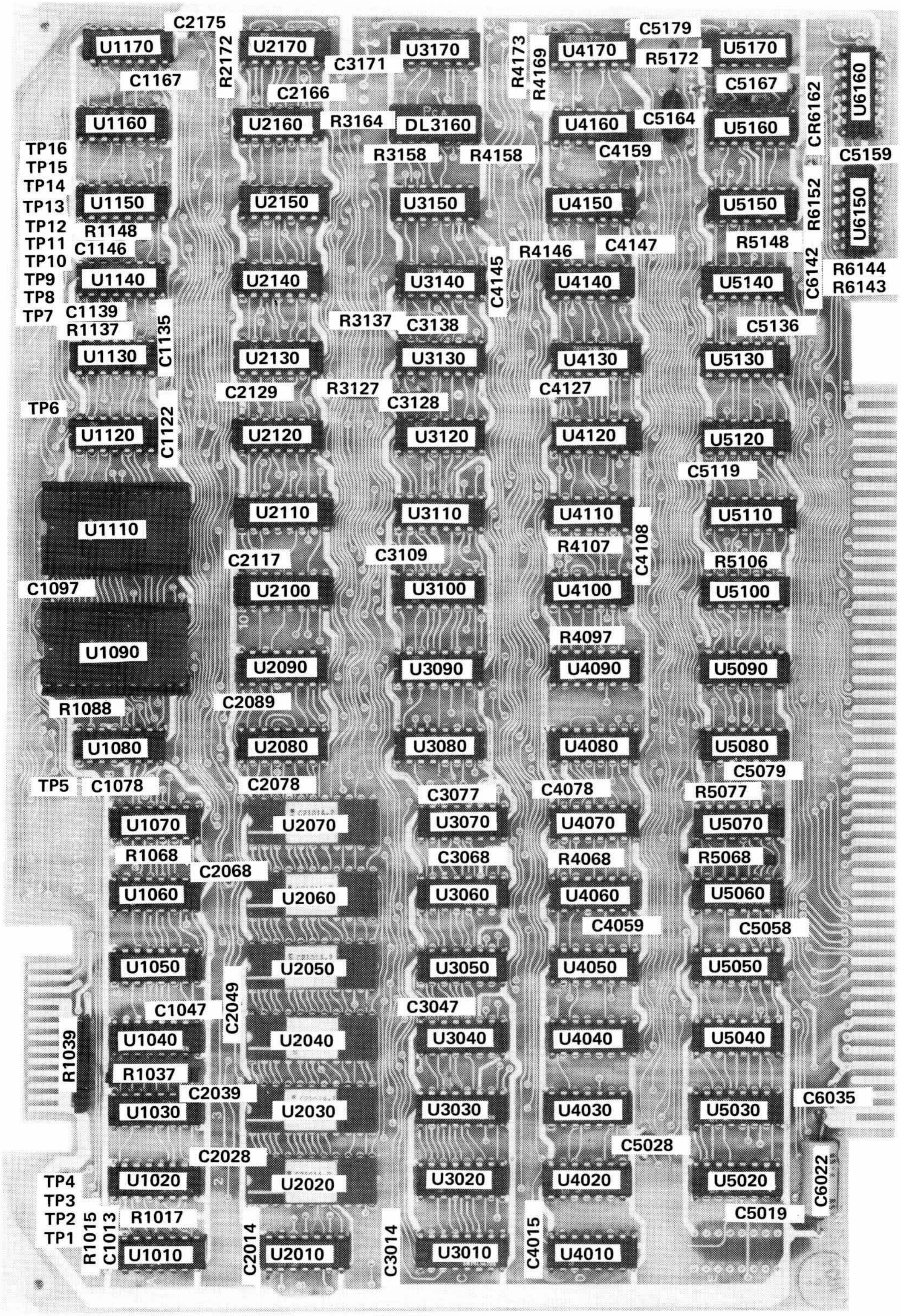
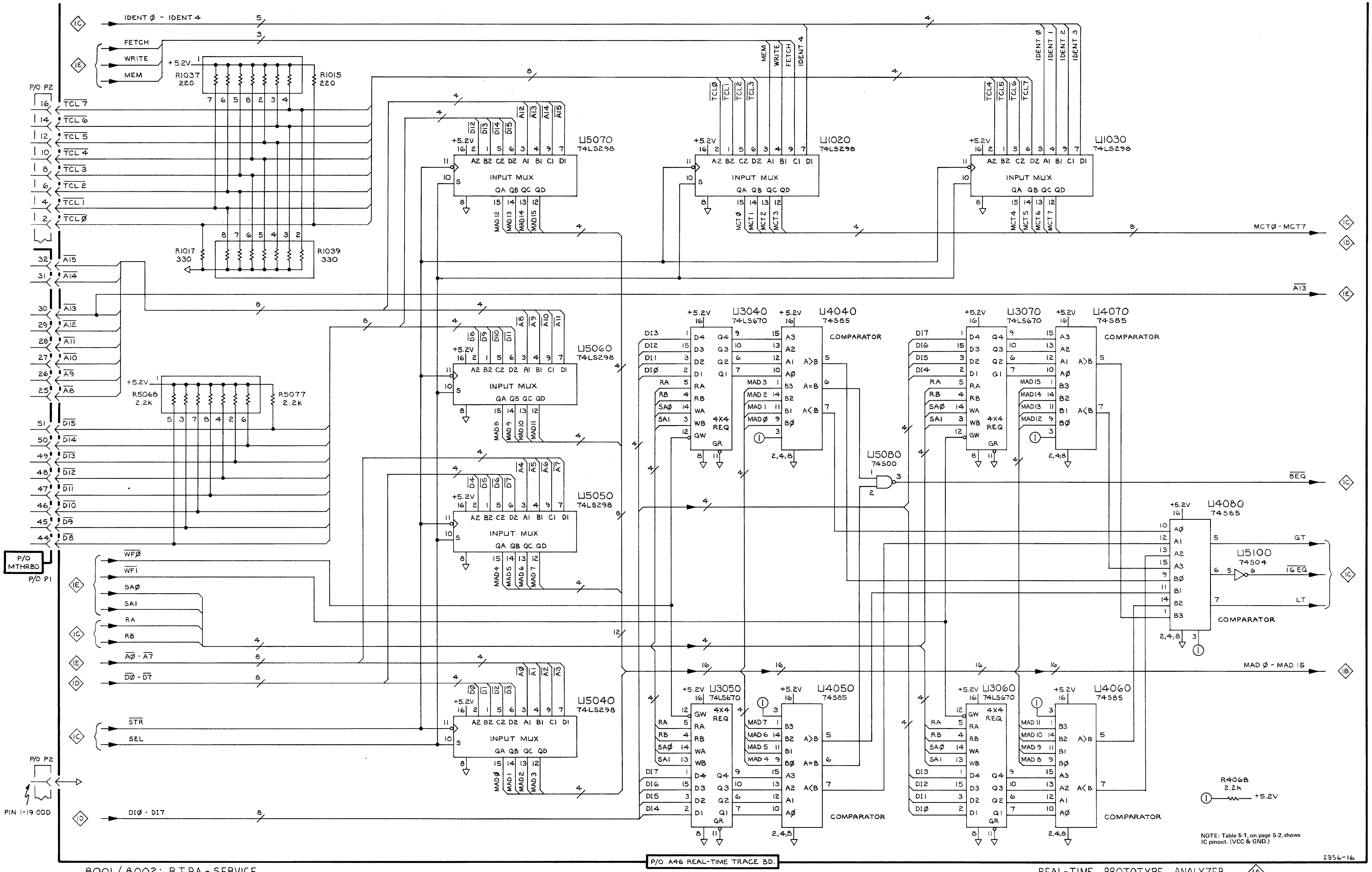
2101-A2	8	22



2356-14

Real-Time Trace Board.



P/O A46 REAL-TIME TRACE BD.

REAL-TIME TRACE

1A

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Table 5-2. Capacitor Information

C1013
C1047
C1078
C1097
C1122
C1135
C1167
C2014
C2028
C2039
C2049
C2068
C2078
C2089
C2117
C2129
C2166
C2175
C3014
C3047
C3068
C3077
C3109
C3171
C4015
C4059
C4078
C4108
C4127
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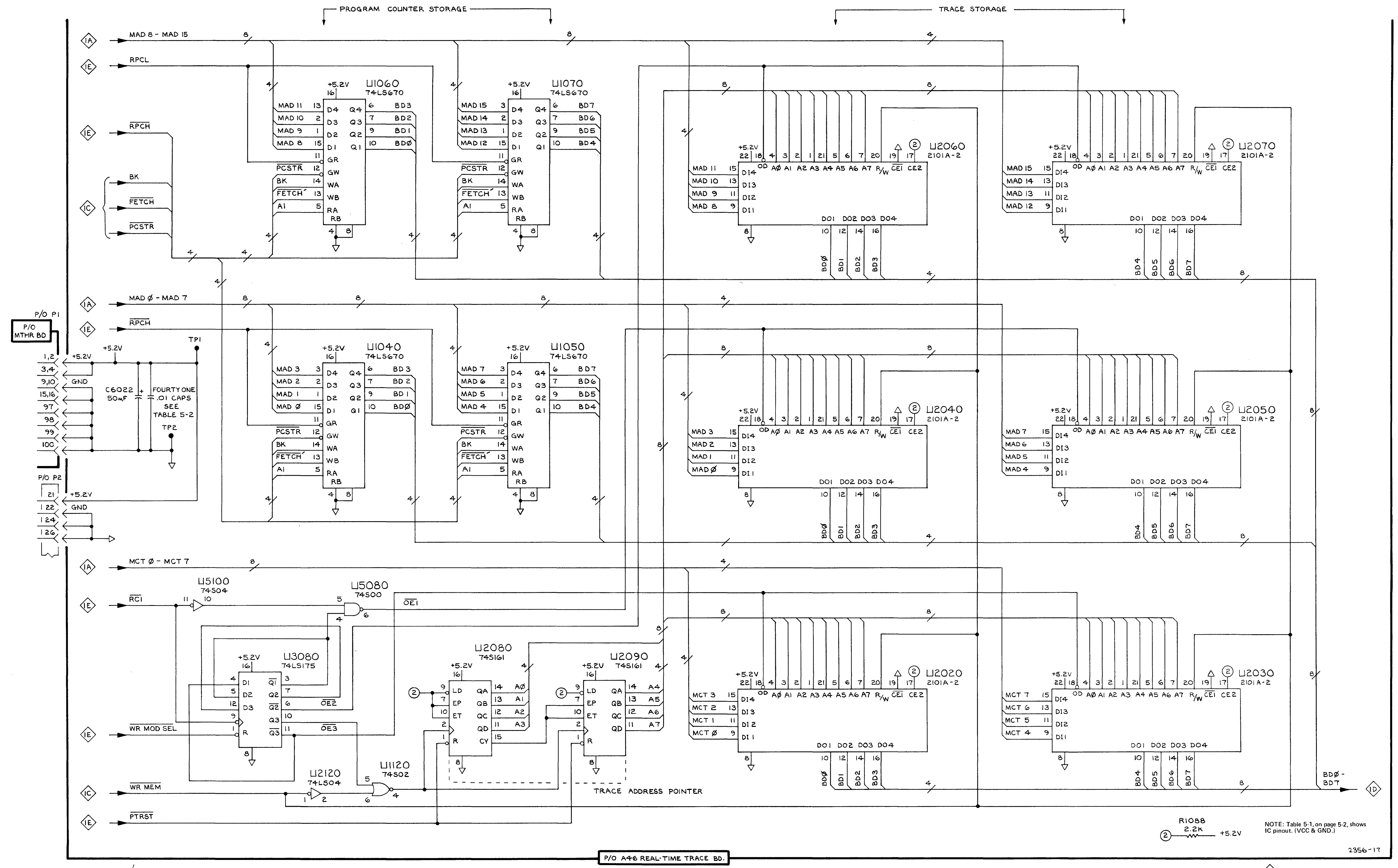
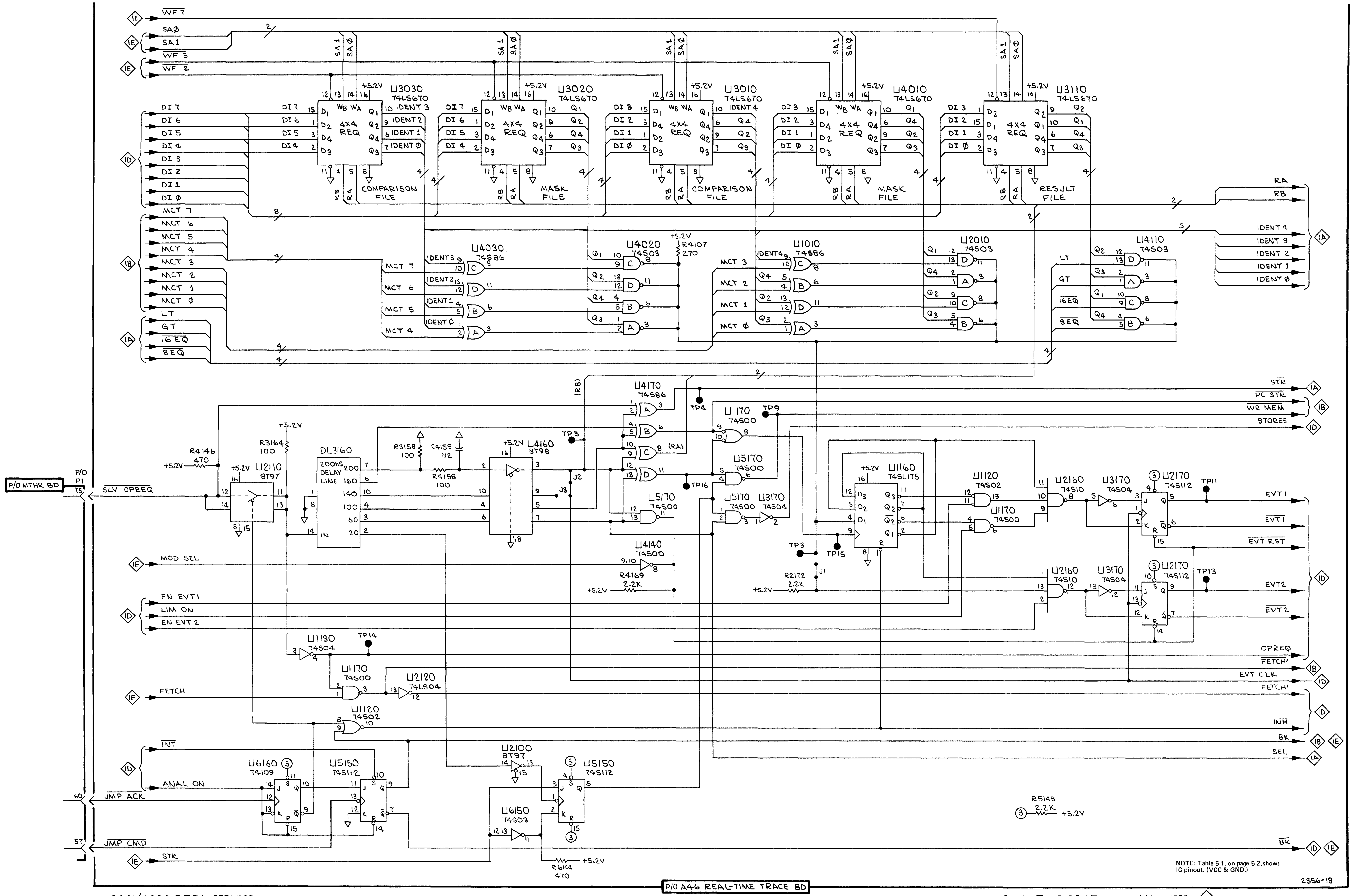
C5159
C4145



NOTE: Table 5-1, on page 5-2, shows IC pinout. (VCC & GND.)

REAL-TIME TRACE

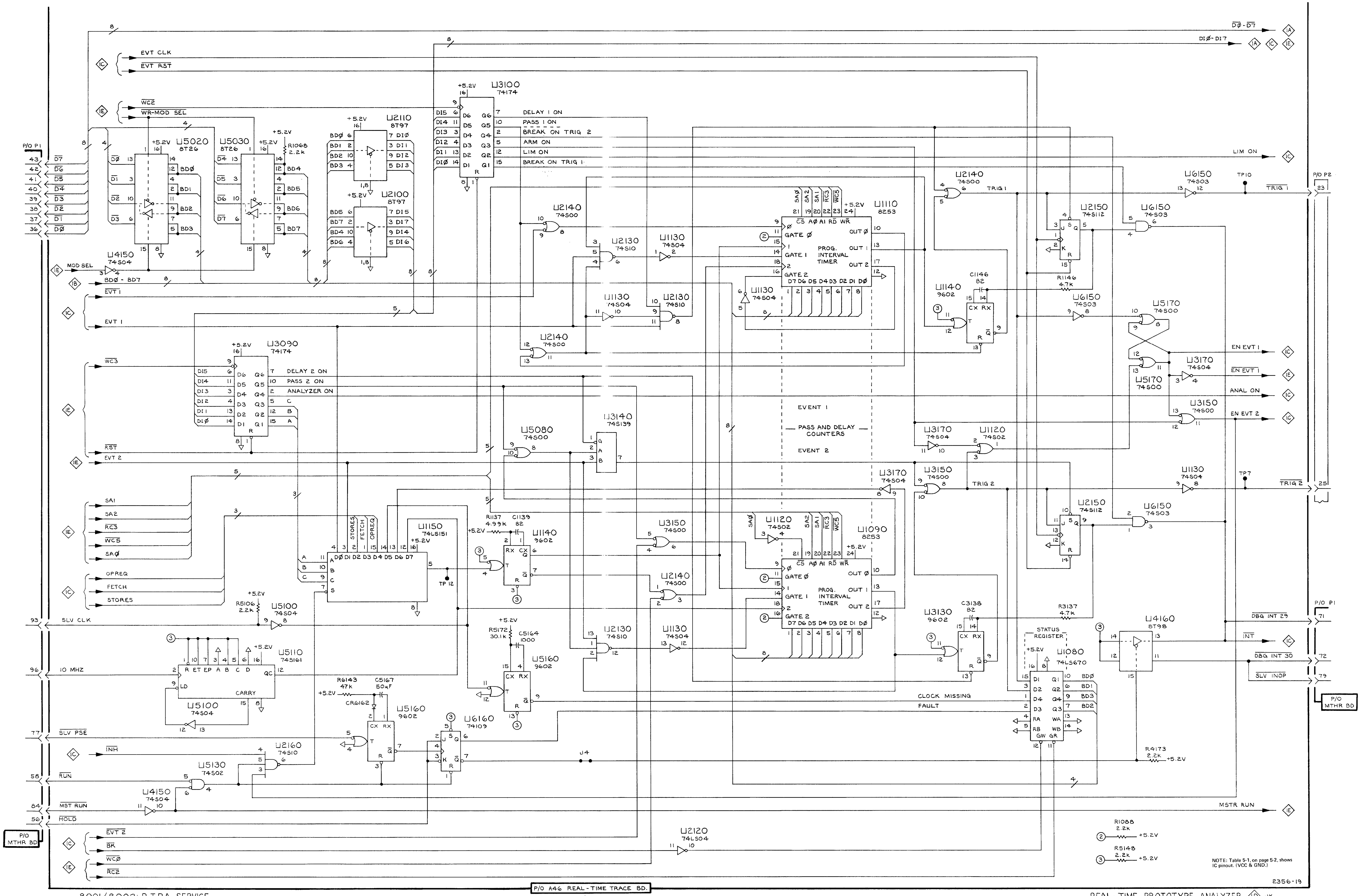
1B



NOTE: Table 5-1, on page 5-2, shows IC pinout. (VCC & GND.)

2356-18

REAL-TIME TRACE

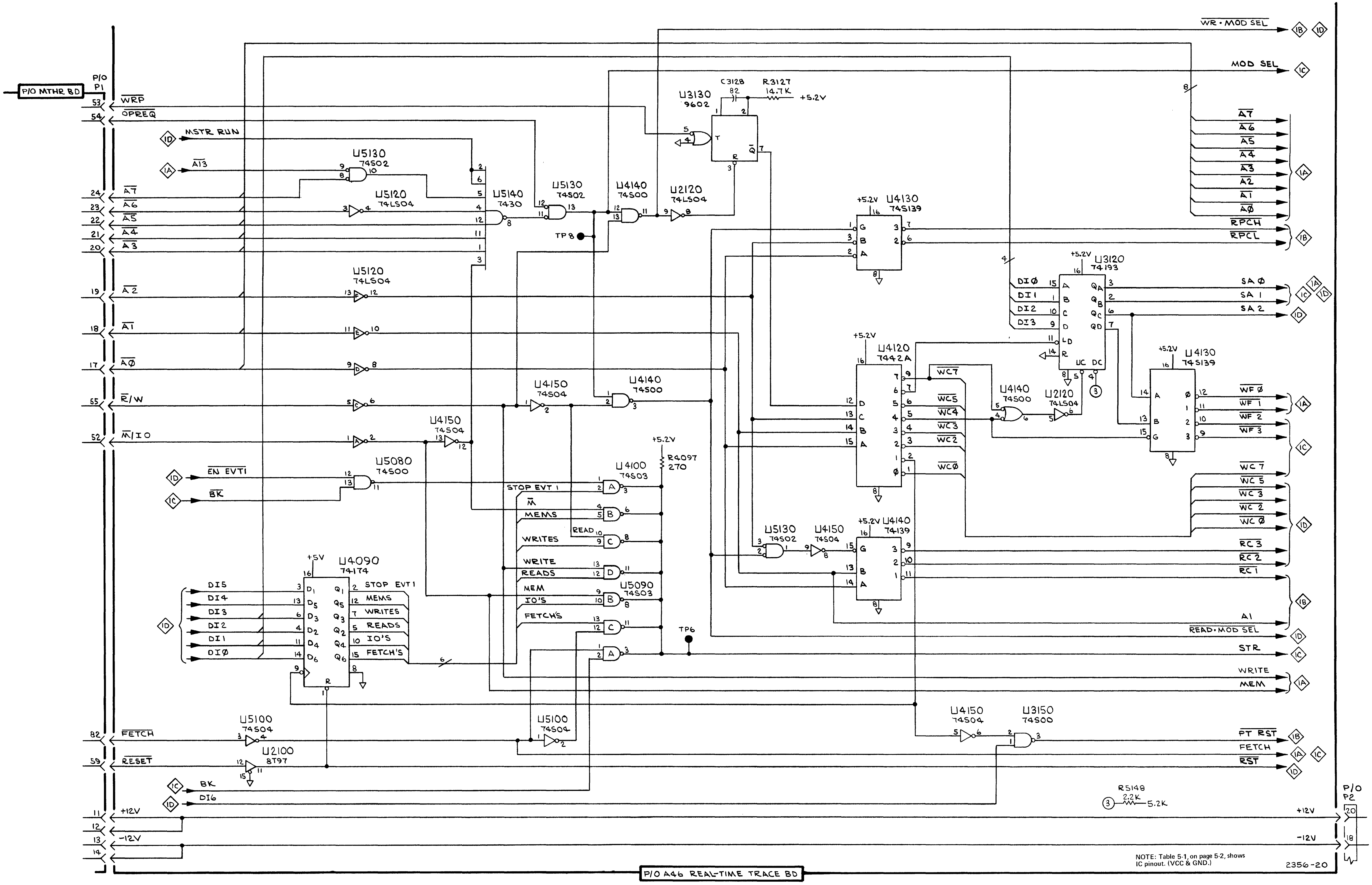


NOTE: Table 5-1, on page 5-2, shows IC pinout. (VCC & GND.)

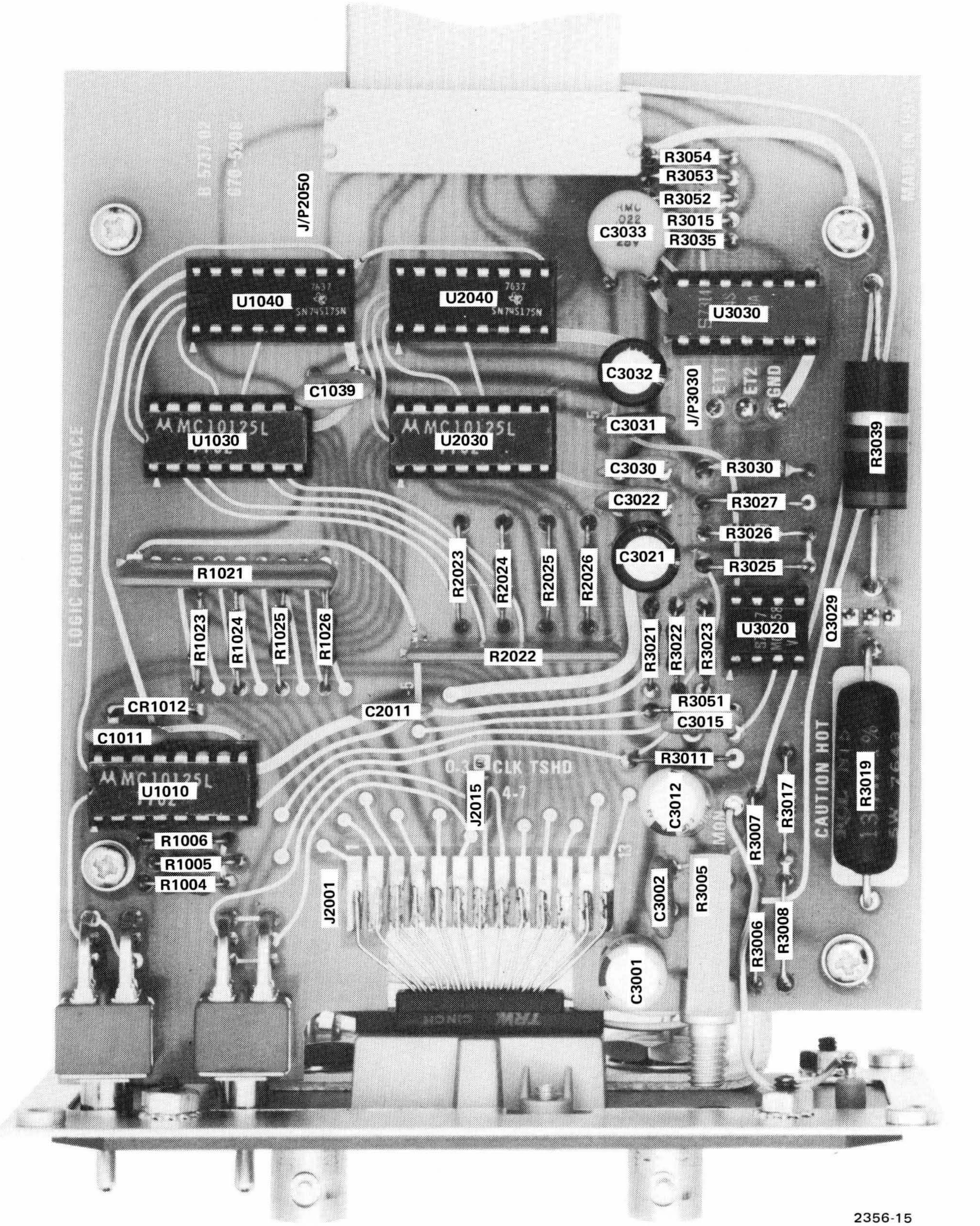
2356-19

P/O A46 REAL-TIME TRACE BD.

@

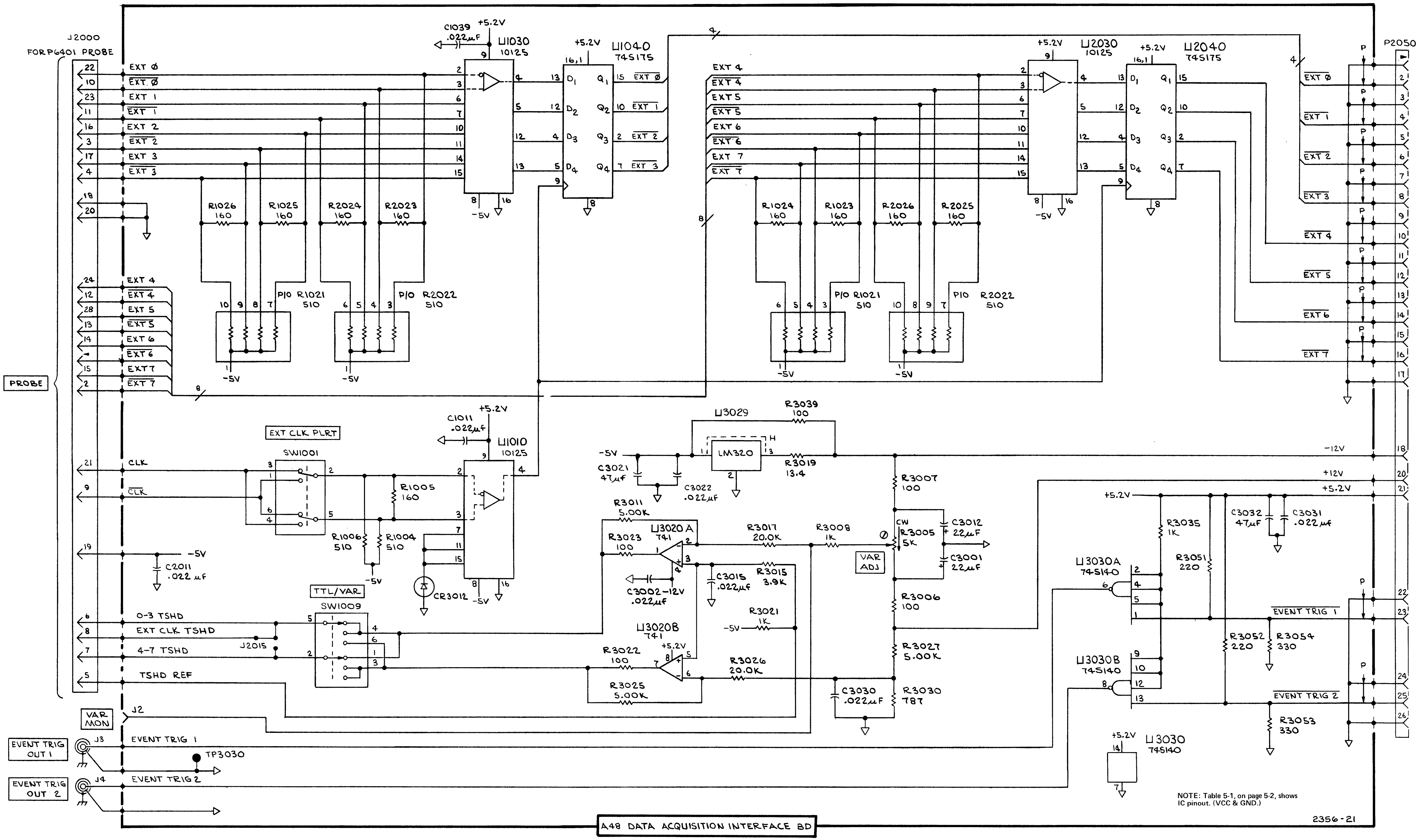


NOTE: Table 5-1, on page 5-2, shows IC pinout. (VCC & GND.)



2356-15

Data Acquisition Interface Board.



NOTE: Table 5-1, on page 5-2, shows IC pinout. (VCC & GND.)

DATA ACQUISITION INTERFACE

②

REPLACEABLE MECHANICAL PARTS

PARTS ORDERING INFORMATION

Replacement parts are available from or through your local Tektronix, Inc. Field Office or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, to include the following information in your order: Part number, instrument type or number, serial number, and modification number if applicable.

If a part you have ordered has been replaced with a new or improved part, your local Tektronix, Inc. Field Office or representative will contact you concerning any change in part number.

Change information, if any, is located at the rear of this manual.

SPECIAL NOTES AND SYMBOLS

X000	Part first added at this serial number
00X	Part removed after this serial number

FIGURE AND INDEX NUMBERS

Items in this section are referenced by figure and index numbers to the illustrations.

INDENTATION SYSTEM

This mechanical parts list is indented to indicate item relationships. Following is an example of the indentation system used in the description column.

1 2 3 4 5 Name & Description

Assembly and/or Component
Attaching parts for Assembly and/or Component
- - - * - - -
Detail Part of Assembly and/or Component
Attaching parts for Detail Part
- - - * - - -
Parts of Detail Part
Attaching parts for Parts of Detail Part
- - - * - - -

Attaching Parts always appear in the same indentation as the item it mounts, while the detail parts are indented to the right. Indented items are part of, and included with, the next higher indentation. The separation symbol - - - * - - - indicates the end of attaching parts.

Attaching parts must be purchased separately, unless otherwise specified.

ITEM NAME

In the Parts List, an Item Name is separated from the description by a colon (:). Because of space limitations, an Item Name may sometimes appear as incomplete. For further Item Name identification, the U.S. Federal Cataloging Handbook H6-1 can be utilized where possible.

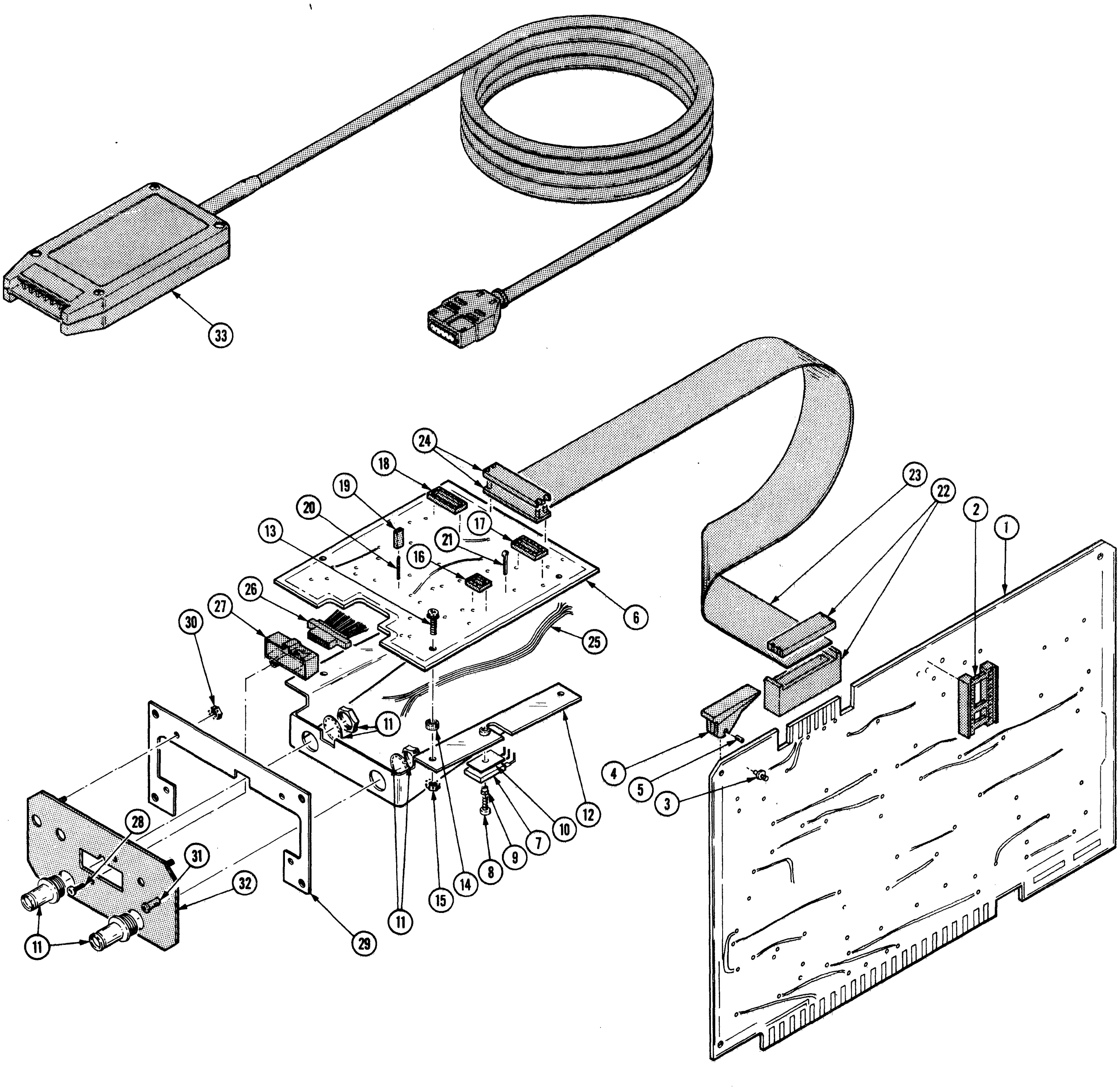
ABBREVIATIONS

"	INCH
#	NUMBER SIZE
ACTR	ACTUATOR
ADPTR	ADAPTER
ALIGN	ALIGNMENT
AL	ALUMINUM
ASSEM	ASSEMBLED
ASSY	ASSEMBLY
ATTEN	ATTENUATOR
AWG	AMERICAN WIRE GAGE
BD	BOARD
BRKT	BRACKET
BRS	BRASS
BRZ	BRONZE
BSHG	BUSHING
CAB	CABINET
CAP	CAPACITOR
CER	CERAMIC
CHAS	CHASSIS
CKT	CIRCUIT
COMP	COMPOSITION
CONN	CONNECTOR
COV	COVER
CPLG	COUPLING
CRT	CATHODE RAY TUBE
DEG	DEGREE
DWR	DRAWER
ELCTRN	ELECTRON
ELEC	ELECTRICAL
ELCTLT	ELECTROLYTIC
ELEM	ELEMENT
EPL	ELECTRICAL PARTS LIST
EQPT	EQUIPMENT
EXT	EXTERNAL
FIL	FILLISTER HEAD
FLEX	FLEXIBLE
FLH	FLAT HEAD
FLTR	FILTER
FR	FRAME or FRONT
FSTNR	FASTENER
FT	FOOT
FXD	FIXED
GSKT	GASKET
HDL	HANDLE
HEX	HEXAGON
HEX HD	HEXAGONAL HEAD
HEX SOC	HEXAGONAL SOCKET
HLCPS	HELICAL COMPRESSION
HLEXT	HELICAL EXTENSION
HV	HIGH VOLTAGE
IC	INTEGRATED CIRCUIT
ID	INSIDE DIAMETER
IDENT	IDENTIFICATION
IMPLR	IMPELLER
IN	INCH
INCAND	INCANDESCENT
INSUL	INSULATOR
INTL	INTERNAL
LPHLDR	LAMPHOLDER
MACH	MACHINE
MECH	MECHANICAL
MTG	MOUNTING
NIP	NIPPLE
NON WIRE	NOT WIRE WOUND
OBD	ORDER BY DESCRIPTION
OD	OUTSIDE DIAMETER
OVH	OVAL HEAD
PH BRZ	PHOSPHOR BRONZE
PL	PLAIN or PLATE
PLSTC	PLASTIC
PN	PART NUMBER
PNH	PAN HEAD
PWR	POWER
RCPT	RECEPTACLE
RES	RESISTOR
RGD	RIGID
RLF	RELIEF
RTNR	RETAINER
SCH	SOCKET HEAD
SCOPE	OSCILLOSCOPE
SCR	SCREW
SE	SINGLE END
SECT	SECTION
SEMICOND	SEMICONDUCTOR
SHLD	SHIELD
SHLDR	SHOULDERED
SKT	SOCKET
SL	SLIDE
SLFLKG	SELF-LOCKING
SLVG	SLEEVING
SPR	SPRING
SQ	SQUARE
SST	STAINLESS STEEL
STL	STEEL
SW	SWITCH
T	TUBE
TERM	TERMINAL
THD	THREAD
THK	THICK
TNSN	TENSION
TPG	TAPPING
TRH	TRUSS HEAD
V	VOLTAGE
VAR	VARIABLE
W/	WITH
WSHR	WASHER
XFMR	TRANSFORMER
XSTR	TRANSISTOR

CROSS INDEX—MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip
000BB	BERQUIST COMPANY	4350 WEST 78TH	MINNEAPOLIS, MN 55435
000CR	MILLENNIUM INFORMATION SYSTEMS, INC.	19020 PRUNERIDGE AVENUE	CUPERTINO, CA 95014
00779	AMP, INC.	P O BOX 3608	HARRISBURG, PA 17105
01295	TEXAS INSTRUMENTS, INC., SEMICONDUCTOR GROUP	P O BOX 5012, 13500 N CENTRAL EXPRESSWAY	DALLAS, TX 75222
08261	SPECTRA-STRIP CORP.	7100 LAMPSON AVE.	GARDEN GROVE, CA 92642
22526	BERG ELECTRONICS, INC.	YOUK EXPRESSWAY	NEW CUMBERLAND, PA 17070
49671	RCA CORPORATION	30 ROCKEFELLER PLAZA	NEW YORK, NY 10020
71279	CAMBRIDGE THERMIONIC CORP.	445 CONCORD AVE.	CAMBRIDGE, MA 02138
71785	TRW, CINCH CONNECTORS	1501 MORSE AVENUE	ELK GROVE VILLAGE, IL 60007
73803	TEXAS INSTRUMENTS, INC., METALLURGICAL MATERIALS DIV.	34 FOREST STREET	ATTLEBORO, MA 02703
75037	MINNESOTA MINING AND MFG. CO., ELECTRO PRODUCTS DIVISION	3M CENTER	ST. PAUL, MN 55101
78189	ILLINOIS TOOL WORKS, INC. SHAKEPROOF DIVISION	ST. CHARLES ROAD	ELGIN, IL 60120
80009	TEKTRONIX, INC.	P O BOX 500	BEAVERTON, OR 97077
83385	CENTRAL SCREW CO.	2530 CRESCENT DR.	BROADVIEW, IL 60153
91836	KINGS ELECTRONICS CO., INC.	40 MARBLEDALE ROAD	TUCKAHOE, NY 10707

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5 Name & Description	Mfr Code	Mfr Part Number
-1	----- -----			1	CKT BOARD ASSY:REAL TIME TRACE(SEE A46 EPL)		
-2	136-0578-00			2	. SOCKET,PLUG-IN:24 DIP,LOW PROFILE	01295	C932402
-3	----- -----			16	. TERM.,TEST PT	000CR	2754-1/4
-4	105-0144-01			1	. EJECTOR,CKT BD:MOLDED PLASTIC W/PIN PKG OF 2	80009	105-0144-01
-5	214-1337-00			2	. . PIN,SPRING:0.10 OD X 0.25 INCH L,STL	80009	214-1337-00
-6	----- -----			1	CKT BOARD ASSY:ACQUISTITION INTFC(SEE A48 EPL)		
-7	----- -----			1	. MICROCIRCUIT,LI:(SEE U3029 EPL)		
					(ATTACHING PARTS)		
-8	211-0097-00			1	. SCREW,MACHINE:4-40 X 0.312 INCH,PNH STL	83385	OBD
-9	210-1178-00			1	. WSHR,SHOULDERED:FOR MTG TO-220 TRANSISTOR	49671	DF 137A
-10	342-0355-00			1	. INSULATOR,PLATE:TRANSISTOR,SILICONE RUBBER	000BB	7403-09FR-51
					- - - * - - -		
-11	131-0274-00			2	. CONNECTOR,RCPT,:BNC	91836	KC79-67
-12	407-2011-00			1	. BRACKET,CKT BD:ALUM.	80009	407-2011-00
					(ATTACHING PARTS)		
-13	211-0121-00			4	. SCR,ASSEM WSHR:4-40 X 0.438 INCH,PNH BRS	83385	OBD
-14	210-1063-00			4	. WASHER,FLAT:0.147 ID X 0.1 THK,ABS,0.29 OD	80009	210-1063-00
-15	210-0586-00			4	. NUT,PLAIN,EXT W:4-40 X 0.25 INCH,STL	78189	OBD
					- - - * - - -		
-16	136-0514-00			1	. SOCKET,PLUG IN:MICROCIRCUIT,8 CONTACT	73803	C9308-02
-17	136-0269-02			1	. SOCKET,PLUG-IN:14 CONTACT,LOW CLEARANCE	01295	C931402
-18	136-0260-02			5	. SOCKET,PLUG-IN:16 CONTACT,LOW CLEARANCE	01295	C931602
-19	131-0993-00			1	. LINK,TERM.CONNE:2 WIRE BLACK	00779	530153-2
-20	131-0608-00			3	. CONTACT,ELEC:0.365 INCH LONG	22526	47357
-21	214-0579-00			1	. TERM.,TEST PT:0.40 INCH LONG	80009	214-0579-00
	198-3717-00			1	. WIRE SET,ELEC:REAL TIME TRACE	80009	198-3717-00
-22	131-2097-00			1	. . CONN,RCPT,ELEC:CIRCUIT BD,26 CONTACTS	75037	3462-0001
-23	175-1525-00			FT	. . CABLE,SP,ELEC:6.6 INCHES	75037	3365-26
-24	131-2098-00			1	. . CONN,RCPT,ELEC:CIRCUIT BD,26 CONTACTS	75037	3434-0000
-25	175-0827-00			FT	. . CABLE,SP,ELEC:4 WIRE RIBBON	08261	OBD
-26	131-1897-00			1	. CONNECTOR,RCPT,:25 MALE CONTACT	71785	DCDA25P4C4010
					(ATTACHING PARTS)		
-27	352-0472-00			1	. HOLDER,SOCKET:	80009	352-0472-00
-28	211-0008-00			2	. SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
					- - - * - - -		
-29	386-3808-00			1	. PL,REAR PNL MTG:	80009	386-3808-00
					(ATTACHING PARTS)		
-30	210-0586-00			4	. NUT,PLAIN,EXT W:4-40 X 0.25 INCH,STL	78189	OBD
					- - - * - - -		
-31	136-0387-00			1	. JACK,TIP:GRAY	71279	450-4352-01-0318
-32	333-2356-00			1	. PANEL,REAR:	80009	333-2356-00
-33	010-6451-01			1	LEAD,TEST:MULTI LEAD,W/ACCESS	80009	010-6451-01



MANUAL CHANGE INFORMATION

At Tektronix, we continually strive to keep up with latest electronic developments by adding circuit and component improvements to our instruments as soon as they are developed and tested.

Sometimes, due to printing and shipping requirements, we can't get these changes immediately into printed manuals. Hence, your manual may contain new change information on following pages.

A single change may affect several sections. Since the change information sheets are carried in the manual until all changes are permanently entered, some duplication may occur. If no such change pages appear following this page, your manual is correct as printed.

SERVICE NOTE

Because of the universal parts procurement problem, some electrical parts in your instrument may be different from those described in the Replaceable Electrical Parts List. The parts used will in no way alter or compromise the performance or reliability of this instrument. They are installed when necessary to ensure prompt delivery to the customer. Order replacement parts from the Replaceable Electrical Parts List.

CALIBRATION TEST EQUIPMENT REPLACEMENT

Calibration Test Equipment Chart

This chart compares TM 500 product performance to that of older Tektronix equipment. Only those characteristics where significant specification differences occur, are listed. In some cases the new instrument may not be a total functional replacement. Additional support instrumentation may be needed or a change in calibration procedure may be necessary.

Comparison of Main Characteristics

DM 501 replaces 7D13		
PG 501 replaces 107	PG 501 - Risetime less than 3.5 ns into 50 Ω.	107 - Risetime less than 3.0 ns into 50 Ω.
108	PG 501 - 5 V output pulse; 3.5 ns Risetime.	108 - 10 V output pulse; 1 ns Risetime.
111	PG 501 - Risetime less than 3.5 ns; 8 ns Pretrigger pulse delay.	111 - Risetime 0.5 ns; 30 to 250 ns Pretrigger Pulse delay.
114	PG 501 - ±5 V output.	114 - ±10 V output. Short proof output.
115	PG 501 - Does not have Paired, Burst, Gated, or Delayed pulse mode; ±5 V dc Offset. Has ±5 V output.	115 - Paired, Burst, Gated, and Delayed pulse mode; ±10 V output. Short-proof output.
PG 502 replaces 107		
108	PG 502 - 5 V output	108 - 10 V output.
111	PG 502 - Risetime less than 1 ns; 10 ns Pretrigger pulse delay.	111 - Risetime 0.5 ns; 30 to 250 ns Pretrigger pulse delay.
114	PG 502 - ±5 V output	114 - ±10 V output. Short proof output.
115	PG 502 - Does not have Paired, Burst, Gated, Delayed & Undelayed pulse mode; Has ±5 V output.	115 - Paired, Burst, Gated, Delayed & Undelayed pulse mode; ±10 V output. Short-proof output.
2101	PG 502 - Does not have Paired or Delayed pulse. Has ±5 V output.	2101 - Paired and Delayed pulse; 10 V output.
PG 506 replaces 106	PG 506 - Positive-going trigger output signal at least 1 V; High Amplitude output, 60 V.	106 - Positive and Negative-going trigger output signal, 50 ns and 1 V; High Amplitude output, 100 V.
067-0502-01	PG 506 - Does not have chopped feature.	0502-01 - Comparator output can be alternately chopped to a reference voltage.
SG 503 replaces 190,		
190A, 190B	SG 503 - Amplitude range 5 mV to 5.5 V p-p.	190B - Amplitude range 40 mV to 10 V p-p.
191	SG 503 - Frequency range 250 kHz to 250 MHz.	191 - Frequency range 350 kHz to 100 MHz.
067-0532-01	SG 503 - Frequency range 250 kHz to 250 MHz.	0532-01 - Frequency range 65 MHz to 500 MHz.
TG 501 replaces 180,		
180A	TG 501 - Marker outputs, 5 sec to 1 ns. Sinewave available at 5, 2, and 1 ns. Trigger output - slaved to marker output from 5 sec through 100 ns. One time-mark can be generated at a time.	180A - Marker outputs, 5 sec to 1 µs. Sinewave available at 20, 10, and 2 ns. Trigger pulses 1, 10, 100 Hz; 1, 10, and 100 kHz. Multiple time-marks can be generated simultaneously.
181	TG 501 - Marker outputs, 5 sec to 1 ns. Sinewave available at 5, 2, and 1 ns.	181 - Marker outputs, 1, 10, 100, 1000, and 10,000 µs, plus 10 ns sinewave.
184	TG 501 - Marker outputs, 5 sec to 1 ns. Sinewave available at 5, 2, and 1 ns. Trigger output - slaved to marker output from 5 sec through 100 ns. One time-mark can be generated at a time.	184 - Marker outputs, 5 sec to 2 ns. Sinewave available at 50, 20, 10, 5, and 2 ns. Separate trigger pulses of 1 and .1 sec; 10, 1, and .1 ms; 10 and 1 µs. Marker amplifier provides positive or negative time marks of 25 V min. Marker intervals of 1 and .1 sec; 10, 1, and .1 ms; 10 and 1 µs.
2901	TG 501 - Marker outputs, 5 sec to 1 ns. Sinewave available at 5, 2, and 1 ns. Trigger output - slaved to marker output from 5 sec through 100 ns. One time-mark can be generated at a time.	2901 - Marker outputs, 5 sec to 0.1 µs. Sinewave available to 50, 10, and 5 ns. Separate trigger pulses, from 5 sec to 0.1 µs. Multiple time-marks can be generated simultaneously.

NOTE: All TM 500 generator outputs are short-proof. All TM 500 plug-in instruments require TM 500-Series Power Module.

REV. A, OCT 1975

MANUAL CHANGE INFORMATION

TEKTRONIX®
committed to
technical excellence

PRODUCT 8001/8002 SERVICE REAL-TIME PROTOTYPE ANALYZER	**CHANGE REFERENCE** C1/877 **DATE** 8-17-77

CHANGE:	**DESCRIPTION**

070-2356-00

SCHEMATIC CORRECTION

DIAGRAM ⟨1D⟩ REAL-TIME PROTOTYPE ANALYZER - Partial